CHAPTER 28

FUEL

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.

CH/SE/SU	C	PAGE	DATE
L.E.P.	R	A	May 31/03
L.E.P.	R	1	May 31/03
L.E.P.	R	2	May 31/03
L.E.P.	R	3	May 31/03
L.E.P.	R	4	May 31/03
L.E.P.	R	5	May 31/03
L.E.P.	R	6	May 31/03
L.E.P.	R	7	May 31/03
L.E.P.	R	8	May 31/03
L.E.P.	R	9	May 31/03
L.E.P.	R	10	May 31/03
L.E.P.	R	11	May 31/03
L.E.P.	R	12	May 31/03
L.E.P.	R	13	May 31/03
L.E.P.	R	14	May 31/03
L.E.P.	R	15	May 31/03
L.E.P.	R	16	May 31/03
L.E.P.	R	17	May 31/03
L.E.P.	R	18	May 31/03
L.E.P.	R	19	May 31/03
L.E.P.	R	20	May 31/03
L.E.P.	R	21	May 31/03
L.E.P.	R	22	May 31/03
L.E.P.	R	23	May 31/03
L.E.P.	R	24	May 31/03
L.E.P.	R	25	May 31/03
L.E.P.	R	26	May 31/03

CHAPTER 28

FUEL

LIST OF EFFECTIVE PAGES

N, R or D indicates pages which are New, Revised or Deleted respectively.

Remove and insert the affected pages and complete the Record of Revisions and the Record of Temporary Revisions as necessary.

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
S.B.LIST		1	May 30/81	T. of C.		27	Mar 31/00
S.B.LIST		2	May 30/81	T. of C.		28	Mar 31/00
S.B.LIST		3	May 30/81	T. of C.		29	Mar 31/00
S.B.LIST		4	May 30/81	T. of C.		30	Mar 30/01
S.B.LIST		5	May 30/81	T. of C.		31	Mar 31/00
S.B.LIST		6	May 30/81				
S.B.LIST		7	May 30/81	28-00-00	R	1	May 31/03
S.B.LIST		8	May 30/81	28-00-00		2	May 30/78
S.B.LIST		9	May 30/81	28-00-00		3	May 30/78
S.B.LIST		10	May 30/81	28-00-00		4	May 30/78
S.B.LIST		11	Aug 30/81	28-00-00		5	May 30/78
S.B.LIST		12	Aug 30/81	28-00-00		6	May 30/78
				28-00-00		7	May 30/78
T. of C.		1	Mar 31/00	28-00-00		8	May 30/78
T. of C.		2	Mar 28/02	28-00-00		9	Aug 30/78
T. of C.		3	Mar 30/01	28-00-00		10	Aug 30/78
T. of C.		4	Mar 31/00	28-00-00		11	May 30/78
T. of C.		5	Mar 30/01	28-00-00		12	May 30/78
T. of C.		6	Mar 31/00	28-00-00		13	May 30/78
T. of C.		7	Mar 31/00	28-00-00		14	May 30/80
T. of C.		8	Mar 30/01	28-00-00		15	Aug 30/78
T. of C.		9	Mar 30/01	28-00-00		16	May 30/78
T. of C.		10	Mar 30/01	28-00-00		17	May 30/78
T. of C.		11	Mar 31/00	28-00-00		18	May 30/78
T. of C.		12	Mar 30/01	28-00-00		19	May 30/78
T. of C.		13	Mar 30/01	28-00-00		20	May 30/78
T. of C.		14	Mar 31/00	28-00-00		21	May 30/78
T. of C.		15	Mar 30/01	28-00-00		22	May 30/78
T. of C.		16	Mar 31/00	28-00-00	R	23	May 31/03
T. of C.		17	Mar 30/01	28-00-00		24	Nov 30/78
T. of C.		18	Mar 31/00	28-00-00		25	Nov 30/78
T. of C.		19	Mar 30/01	28-00-00		26	Nov 30/78
T. of C.		20	Mar 30/01	28-00-00		27	Nov 30/78
T. of C.		21	Mar 30/01	28-00-00		28	Nov 30/78
T. of C.		22	Mar 31/00	28-00-00		29	Nov 30/78
T. of C.		23	Mar 31/00	28-00-00		30	Nov 30/78
T. of C.		24	Mar 31/00	28-00-00		31	Nov 30/78
T. of C.		25	Mar 31/00	28-00-00		32	Nov 30/78
T. of C.		26	Mar 31/00	28-00-00		33	Nov 30/78

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
28-00-00		34	Nov 30/78	28-00-00		425	May 30/83
28-00-00		35	Nov 30/78	28-00-00		426	Feb 29/80
28-00-00		36	Nov 30/78	28-00-00		427	Feb 29/80
28-00-00		37	Nov 30/78	28-00-00		428	May 30/80
28-00-00		38	Nov 30/78	28-00-00		429	Feb 29/80
28-00-00		39	Feb 29/80	28-00-00		430	Feb 29/80
28-00-00		40	Nov 30/78	28-00-00		431	Feb 29/80
28-00-00		41	Nov 30/78	28-00-00		432	Feb 29/80
28-00-00		42	Nov 30/78	28-00-00		433	Feb 29/80
28-00-00		43	Nov 30/78	28-00-00		434	Feb 29/80
28-00-00		44	Nov 30/78	28-00-00		435	Feb 29/80
28-00-00		45	Nov 30/78	28-00-00		436	Feb 29/80
28-00-00		301	Mar 30/01	28-00-00		437	Feb 29/80
28-00-00		302	Mar 30/01	28-00-00		438	Feb 29/80
28-00-00		303	Mar 30/01	28-00-00		439	Feb 29/80
28-00-00		304	Mar 30/01	28-00-00		440	May 30/81
28-00-00		305	Mar 30/01	28-00-00		441	May 30/81
28-00-00		306	Mar 30/01	28-00-00		442	May 30/81
28-00-00		307	Mar 30/01	28-00-00		443	May 30/81
28-00-00		308	Mar 30/01	28-00-00		444	Feb 28/81
28-00-00		309	Mar 30/01	28-00-00		445	May 30/81
28-00-00		310	Mar 30/01				
28-00-00		311	Mar 30/01	28-10-00		301	May 30/79
28-00-00		312	Mar 30/01	28-10-00		302	May 30/79
28-00-00		313	Mar 30/01	28-10-00		303	Mar 31/00
28-00-00		314	Mar 30/01	28-10-00		304	Mar 31/00
28-00-00		401	Aug 30/75	28-10-00		305	May 30/79
28-00-00		402	Aug 30/75	28-10-00		306	Jun 30/75
28-00-00		403	Aug 30/75	28-10-00		307	Jun 30/75
28-00-00		404	Aug 30/75	28-10-00		308	May 30/79
28-00-00		405	Aug 30/75	28-10-00		309	May 30/79
28-00-00		406	Aug 30/75	28-10-00		310	Aug 30/76
28-00-00		407	Aug 30/75	28-10-00		311	Aug 30/76
28-00-00		408	Aug 30/75	28-10-00		312	May 30/77
28-00-00		409	Aug 30/75	28-10-00		313	May 30/77
28-00-00		410	Aug 30/75	28-10-00		314	May 30/79
28-00-00		411	Aug 30/75	28-10-00		315	Mar 31/00
28-00-00		412	Aug 30/75	28-10-00		316	Mar 31/00
28-00-00		413	Nov 30/75	28-10-00		317	Mar 31/00
28-00-00		414	Aug 30/75	28-10-00		318	Mar 31/00
28-00-00		415	Aug 30/75	28-10-00		319	Mar 31/00
28-00-00		416	Aug 30/75	28-10-00		320	Mar 31/00
28-00-00		417	Aug 30/75	28-10-00		321	Mar 31/00
28-00-00		418	Feb 29/80	28-10-00		322	Mar 31/00
28-00-00		419	Feb 29/80	28-10-00		323	Mar 31/00
28-00-00		420	Feb 29/80	28-10-00		324	Mar 31/00
28-00-00		421	Feb 29/80	28-10-00		325	Mar 31/00
28-00-00		422	Feb 29/80	28-10-00		326	Mar 31/00
28-00-00		423	Feb 29/80	28-10-00		327	Mar 31/00
28-00-00		424	Feb 29/80	28-10-00		328	Mar 31/00

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
28-10-00		329	Mar 31/00	28-11-00		530	Mar 31/00
				28-11-00		531	Mar 31/00
28-11-00	R	1	May 31/03	28-11-00		532	Mar 31/00
28-11-00	R	2	May 31/03	28-11-00		533	Mar 31/00
28-11-00	R	3	May 31/03	28-11-00		534	Mar 31/00
28-11-00	R	4	May 31/03	28-11-00		535	Mar 28/02
28-11-00		5	Jun 30/75	28-11-00		536	Mar 28/02
28-11-00		6	Feb 29/80	28-11-00		537	Mar 28/02
28-11-00		7	Feb 29/80	28-11-00		538	Mar 28/02
28-11-00		8	Aug 30/76	28-11-00		601	Mar 31/99
28-11-00		9	Feb 29/80	28-11-00		602	Mar 31/99
28-11-00		10	Feb 29/80	28-11-00		603	Mar 31/99
28-11-00		11	Nov 30/77	28-11-00		604	Aug 30/76
28-11-00		12	Aug 30/75	28-11-00		605	Aug 30/76
28-11-00		13	Aug 30/75	28-11-00		606	Mar 31/99
28-11-00		14	Aug 30/75	28-11-00		607	Mar 31/00
28-11-00		15	Feb 29/80	28-11-00		608	Mar 31/00
28-11-00		16	Aug 30/75	28-11-00		609	Mar 31/00
28-11-00		17	Feb 29/80	28-11-00		610	Mar 31/00
28-11-00		501	Nov 30/77	28-11-00		611	Mar 31/00
28-11-00		502	Nov 30/77	28-11-00		612	Mar 31/00
28-11-00		503	Nov 30/77	28-11-00		613	Mar 31/00
28-11-00		504	Nov 30/77	28-11-00		701	Mar 31/00
28-11-00		505	Nov 30/77	28-11-00		702	Mar 31/00
28-11-00		506	Nov 30/77	28-11-00		703	Mar 31/00
28-11-00		507	Nov 30/77	28-11-00		704	Mar 31/00
28-11-00		508	Nov 30/77	28-11-00		705	Mar 31/00
28-11-00		509	Nov 30/77	28-11-00		706	Mar 31/00
28-11-00		510	Nov 30/77	28-11-00		707	Mar 31/00
28-11-00		511	Nov 30/77	28-11-00		801	Aug 30/77
28-11-00		512	Nov 30/77	28-11-00		802	Sep 29/80
28-11-00		513	Nov 30/77	28-11-00		802 A	Sep 29/89
28-11-00		514	Nov 30/77	28-11-00		802 B	Sep 29/89
28-11-00		515	Nov 30/77	28-11-00		802 C	Sep 29/89
28-11-00		516	Nov 30/77	28-11-00		802 D	Mar 27/97
28-11-00		517	Mar 31/00	28-11-00		802 E	Mar 27/97
28-11-00		518	Mar 31/00	28-11-00		802 F	Mar 27/97
28-11-00		519	Mar 31/00	28-11-00		802 G	Mar 27/97
28-11-00		520	Mar 31/00	28-11-00		802 H	Mar 27/97
28-11-00		520 A	Mar 31/00	28-11-00		803	Aug 30/76
28-11-00		520 B	Mar 31/00	28-11-00		804	Sep 30/93
28-11-00		521	Mar 31/00	28-11-00		805	Mar 31/00
28-11-00		522	Mar 31/00	28-11-00		806	Mar 31/00
28-11-00		523	Mar 31/00	28-11-00		807	Mar 31/00
28-11-00		524	Mar 31/00	28-11-00		808	Mar 31/00
28-11-00		525	Mar 31/00	28-11-00		809	Mar 31/00
28-11-00		526	Mar 31/00	28-11-00		810	Mar 31/00
28-11-00		527	Mar 31/00	28-11-00		811	Mar 31/00
28-11-00		528	Mar 31/00	28-11-00		812	Mar 31/00
28-11-00		529	Mar 31/00	28-11-00		813	Mar 31/00

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
28-11-00		814	Mar 31/00	28-11-12		404	Mar 30/01
28-11-00		815	Nov 30/77	28-11-12		405	Mar 30/01
28-11-00		816	Aug 30/77	28-11-12		406	Mar 30/01
28-11-00		817	Nov 30/77	28-11-12		407	Mar 30/01
28-11-00		818	Nov 30/77	28-11-12		408	Mar 30/01
28-11-00		819	Nov 30/77	28-11-12		409	Mar 30/01
28-11-00		820	Nov 30/77	28-11-12		410	Mar 30/01
28-11-00		821	Mar 31/00	28-11-12		411	Mar 30/01
28-11-00		822	Mar 31/00	28-11-12		412	Mar 30/01
28-11-00		823	Mar 31/00	28-11-12		413	Mar 30/01
28-11-00		824	Mar 31/00	28-11-12		501	Aug 30/75
28-11-00		825	Feb 29/80	28-11-12		502	Aug 30/75
28-11-00		826	Feb 29/80	28-11-22		401	Aug 30/77
28-11-00		827	Mar 31/00	28-11-22		402	Aug 30/77
28-11-00		828	Mar 31/00	28-11-22		403	Aug 30/77
28-11-00		829	Mar 31/00	28-11-22		501	Aug 30/76
28-11-00		830	Mar 31/00	28-11-22		502	Aug 30/76
28-11-00		831	Mar 31/00				
28-11-00		832	Mar 31/00	28-12-00		1	Aug 30/79
28-11-00		833	Mar 31/00	28-12-00		2	May 30/77
28-11-00		834	Mar 31/00	28-12-00		3	Aug 30/79
28-11-00		835	Mar 31/00	28-12-00		4	Aug 30/79
28-11-00		836	Mar 31/00	28-12-00		5	Aug 30/79
28-11-00		836 A	Mar 31/00	28-12-00		6	Aug 30/79
28-11-00		836 B	Mar 31/00	28-12-00		7	Aug 30/79
28-11-00		837	Mar 31/00	28-12-00		8	Aug 30/79
28-11-00		838	Mar 31/00	28-12-00		9	Aug 30/79
28-11-00		839	Sep 30/87	28-12-00		10	Aug 30/79
28-11-00		840	Nov 30/80	28-12-00		11	Aug 30/79
28-11-00		841	Sep 30/87	28-12-00		12	Aug 30/79
28-11-00		842	Nov 30/80	28-12-00		13	Aug 30/79
28-11-00		843	Mar 31/99	28-12-00		14	Aug 30/79
28-11-00		844	Mar 31/99	28-12-00		15	Aug 30/79
28-11-00		845	Mar 31/99	28-12-00		16	Aug 30/79
28-11-00		846	Mar 31/99	28-12-00		17	Aug 30/79
28-11-00		847	Mar 31/99	28-12-00		18	Aug 30/79
28-11-00		848	Mar 31/99	28-12-00		19	Aug 30/79
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28-11-00		850	Mar 31/99	28-12-00		21	Aug 30/79
28-11-00		851	Mar 31/00	28-12-00		22	Aug 30/79
28-11-00		852	Mar 31/00	28-12-00	R	23	May 31/03
28-11-11		401	Nov 30/75	28-12-00		24	Feb 29/80
28-11-11		402	Nov 30/79	28-12-00		25	Aug 30/79
28-11-11		403	Nov 30/75	28-12-00		26	Aug 30/79
28-11-11		404	May 30/76	28-12-00		27	Aug 30/79
28-11-11		405	Aug 30/78	28-12-00		28	Aug 30/79
28-11-11		406	Nov 30/75	28-12-00		29	Aug 30/79
28-11-12		401	Mar 30/01	28-12-00		101	May 30/76
28-11-12		402	Mar 30/01	28-12-00		102	May 30/76
28-11-12		403	Mar 30/01	28-12-00		103	Aug 30/78

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
28-12-00		104	May 30/76	28-12-00		417	Aug 30/80
28-12-00		105	Aug 30/78	28-12-00		418	Aug 30/80
28-12-00		106	Aug 30/78	28-12-00		419	Aug 30/80
28-12-00		107	Aug 30/78	28-12-00		420	Aug 30/80
28-12-00		108	Aug 30/78	28-12-00		421	May 30/80
28-12-00		109	Aug 30/78	28-12-00		422	May 30/80
28-12-00		110	Aug 30/78	28-12-00		423	May 30/80
28-12-00		111	May 30/76	28-12-00		424	May 30/80
28-12-00		112	May 30/76	28-12-00		425	May 30/80
28-12-00		113	May 30/76	28-12-00		426	May 30/80
28-12-00		114	May 30/76	28-12-00		427	May 30/80
28-12-00		115	May 30/76	28-12-00		428	Aug 30/80
28-12-00		116	May 30/76	28-12-00		429	May 30/80
28-12-00		117	May 30/76	28-12-00		430	Aug 30/80
28-12-00		118	May 30/76	28-12-00		431	May 30/80
28-12-00		119	May 30/76	28-12-00		432	May 30/80
28-12-00		120	May 30/76	28-12-00		433	Aug 30/80
28-12-00		121	May 30/76	28-12-00		434	May 30/80
28-12-00		122	May 30/76	28-12-00		435	May 30/80
28-12-00		123	May 30/76	28-12-00		436	May 30/80
28-12-00		124	May 30/76	28-12-00		437	May 30/80
28-12-00		125	May 30/76	28-12-00		438	Aug 30/80
28-12-00		126	May 30/76	28-12-00		439	May 30/80
28-12-00		127	May 30/76	28-12-00		440	May 30/80
28-12-00		128	May 30/79	28-12-00		441	May 30/80
28-12-00		129	May 30/76	28-12-00		442	May 30/80
28-12-00		130	May 30/76	28-12-00		443	May 30/80
28-12-00		131	Nov 30/79	28-12-00		444	May 30/80
28-12-00		132	Nov 30/79	28-12-00		445	May 30/80
28-12-00		133	Nov 30/79	28-12-00		446	May 30/80
28-12-00		134	Nov 30/79	28-12-00		447	May 30/80
28-12-00		135	Nov 30/79	28-12-00		448	May 30/80
28-12-00		136	Nov 30/79	28-12-00		449	May 30/80
28-12-00		137	Nov 30/79	28-12-00		450	May 30/80
28-12-00		401	May 30/80	28-12-00		451	May 30/80
28-12-00		402	Aug 30/80	28-12-00		501	Mar 30/01
28-12-00		403	Aug 30/80	28-12-00		502	Mar 30/01
28-12-00		404	May 30/80	28-12-00		503	Mar 30/01
28-12-00		405	Aug 30/80	28-12-00		504	Mar 30/01
28-12-00		406	May 30/80	28-12-00		505	Mar 30/01
28-12-00		407	Nov 30/80	28-12-00		506	Sep 30/88
28-12-00		408	May 30/80	28-12-00		507	May 30/78
28-12-00		409	May 30/80	28-12-00		508	May 30/78
28-12-00		410	May 30/80	28-12-00		509	Aug 30/76
28-12-00		411	Aug 30/80	28-12-00		510	Aug 30/76
28-12-00		412	May 30/80	28-12-00		511	Aug 30/76
28-12-00		413	May 30/80	28-12-00		512	May 30/78
28-12-00		414	May 30/80	28-12-00		513	Feb 28/78
28-12-00		415	Aug 30/80	28-12-00		514	Aug 30/76
28-12-00		416	Aug 30/80	28-12-00		515	Aug 30/76

CH/SE/SU	C	PAGE	DATE	CH/SE/SU	C	PAGE	DATE
28-12-00		516	Aug 30/76	28-12-11		503	Aug 30/76
28-12-00		517	Aug 30/76	28-12-11		504	Aug 30/76
28-12-00		518	Aug 30/76	28-12-12		401	May 30/76
28-12-00		519	Aug 30/76	28-12-12		402	May 30/76
28-12-00		520	Aug 30/76	28-12-12		403	May 30/76
28-12-00		521	Aug 30/76	28-12-12		404	May 30/76
28-12-00		522	Aug 30/76	28-12-12		405	May 30/76
28-12-00		523	Aug 30/76	28-12-12		406	May 30/76
28-12-00		524	Aug 30/76	28-12-12		407	May 30/76
28-12-00		525	Aug 30/76	28-12-12		408	May 30/76
28-12-00		526	Aug 30/76	28-12-12		409	May 30/76
28-12-00		527	Aug 30/76	28-12-12		410	May 30/76
28-12-00		528	Aug 30/76	28-12-12		601	May 30/76
28-12-00		529	Aug 30/76	28-12-12		602	May 30/76
28-12-00		530	Aug 30/76	28-12-14		401	Mar 30/01
28-12-00		531	May 30/78	28-12-14		402	Mar 30/01
28-12-00		532	May 30/78	28-12-14		403	Mar 30/01
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28-23-31		411	Mar 30/01	28-23-52		501	May 30/76
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28-24-23		404	Feb 29/76	28-25-00		505	Aug 30/80

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28-40-00		523	Sep 30/87	28-42-00		113	Nov 30/76
28-40-00		524	Aug 30/77	28-42-00		114	Nov 30/79
28-40-00		525	Aug 30/77	28-42-00		115	Nov 30/79
28-40-00		526	Aug 30/77	28-42-00		116	Nov 30/79
28-40-00		527	Aug 30/77	28-42-00		117	Nov 30/79
28-40-00		528	Aug 30/77	28-42-00		118	Nov 30/79
28-40-00		529	Aug 30/77	28-42-00		119	Nov 30/79

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28-42-00		501	Nov 30/76	28-44-00		25	Feb 29/80
28-42-00		502	Nov 30/76	28-44-00		101	May 30/76
28-42-00		503	Feb 28/77	28-44-00		102	Mar 31/98
28-42-00		504	Feb 28/77	28-44-00		103	Mar 27/97
28-42-00		505	Feb 28/77	28-44-00		104	Mar 31/98
28-42-00		506	Feb 28/77	28-44-00		105	Mar 31/98
28-42-51		401	May 30/76	28-44-00		106	Mar 31/98
28-42-51		402	May 30/76	28-44-00		107	Aug 30/80
28-42-51		403	Feb 28/77	28-44-00		108	Aug 30/80
28-42-51		404	Nov 30/76	28-44-00		109	Aug 30/80
				28-44-00		110	Aug 30/80
28-43-00		1	Nov 30/78	28-44-00		111	Aug 30/80
28-43-00		2	Aug 30/75	28-44-00		112	Aug 30/80
28-43-00		101	Nov 30/78	28-44-00		113	Aug 30/80
28-43-00		102	Jun 30/75	28-44-00		114	Aug 30/80
28-43-00		103	Jun 30/75	28-44-00		115	May 30/83
28-43-00		104	Jun 30/75	28-44-00		116	May 30/83
28-43-00		105	Jun 30/75	28-44-00		117	May 30/83
28-43-00		106	Nov 30/79	28-44-00		118	May 30/83
28-43-00		501	Nov 30/78	28-44-00		119	May 30/83
28-43-00		502	Aug 30/75	28-44-00		401	Aug 30/80
28-43-11		401	Aug 30/75	28-44-00		402	Aug 30/80
28-43-11		402	Jun 30/75	28-44-00		403	Nov 30/79
28-43-11		403	Jun 30/75	28-44-00		404	Nov 30/79
28-43-11		404	Jun 30/75	28-44-00		405	Nov 30/79
				28-44-00		406	Nov 30/79
28-44-00		1	Aug 30/75	28-44-00		407	Nov 30/79
28-44-00		2	Feb 28/77	28-44-00		501	Feb 29/76
28-44-00		3	Aug 30/75	28-44-00		502	Aug 30/76
28-44-00		4	Nov 30/77	28-44-00		503	May 30/82
28-44-00		5	Feb 28/77	28-44-00		504	May 30/82
28-44-00		6	Aug 30/75	28-44-00		505	Aug 30/80
28-44-00		7	Feb 28/77	28-44-00		506	Sep 30/87
28-44-00		8	Feb 28/77	28-44-00		507	Feb 29/80
28-44-00		9	Feb 28/77	28-44-00		508	Aug 30/80
28-44-00		10	Feb 28/77	28-44-00		509	Nov 30/85
28-44-00		11	Feb 28/77	28-44-00		510	Nov 30/85
28-44-00		12	Feb 28/77	28-44-00		511	Feb 29/80
28-44-00		13	May 30/81	28-44-00		512	Feb 29/80
28-44-00		14	Feb 28/77	28-44-00		513	Feb 29/80
28-44-00		15	Feb 28/77	28-44-00		514	Feb 29/80
28-44-00		16	Feb 28/77	28-44-00		515	Feb 29/80
28-44-00		17	Feb 28/77	28-44-00		516	Feb 29/80
28-44-00		18	Feb 28/77	28-44-00		517	Feb 29/80
28-44-00		19	Feb 28/77	28-44-00		518	Feb 29/80
28-44-00		20	Feb 28/77	28-44-11		401	Mar 30/01
28-44-00		21	Feb 28/77	28-44-11		402	Mar 30/01
28-44-00		22	Feb 28/78	28-44-11		403	Mar 30/01
28-44-00		23	Aug 30/80	28-44-11		404	Mar 30/01
28-44-00		24	Feb 29/80	28-44-11		405	Mar 30/01

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28-44-11		406	Mar 30/01	28-44-31		425	Mar 30/01
28-44-11		407	Mar 30/01	28-44-32		401	Sep 29/89
28-44-11		408	Mar 30/01	28-44-32		401 A	Sep 29/89
28-44-11		409	Mar 30/01	28-44-32		402	Feb 29/76
28-44-11		410	Mar 30/01	28-44-32		403	Sep 29/89
28-44-11		411	Mar 30/01	28-44-32		404	Feb 29/76
28-44-11		412	Mar 30/01	28-44-32		405	Feb 29/76
28-44-11		413	Mar 30/01	28-44-32		406	May 30/80
28-44-11		414	Mar 30/01	28-44-32		407	May 30/80
28-44-11		415	Mar 30/01	28-44-32		408	May 30/80
28-44-11		416	Mar 30/01	28-44-32		409	May 30/80
28-44-11		417	Mar 30/01	28-44-32		410	May 30/80
28-44-12		401	Aug 30/80	28-44-33		401	Mar 30/01
28-44-12		402	Aug 30/78	28-44-33		402	Mar 30/01
28-44-12		403	Aug 30/78	28-44-33		403	Mar 30/01
28-44-12		404	Aug 30/78	28-44-33		404	Mar 30/01
28-44-12		405	Aug 30/78	28-44-33		405	Mar 30/01
28-44-12		406	May 30/80	28-44-33		406	Mar 30/01
28-44-12		407	May 30/80	28-44-33		407	Mar 30/01
28-44-12		408	Aug 30/78	28-44-33		408	Mar 30/01
28-44-12		409	Aug 30/78	28-44-33		409	Mar 30/01
28-44-12		410	May 30/80	28-44-33		410	Mar 30/01
28-44-12		411	May 30/80	28-44-33		411	Mar 30/01
28-44-12		412	May 30/80	28-44-33		412	Mar 30/01
28-44-12		413	Sep 30/93	28-44-33		413	Mar 30/01
28-44-12		414	Sep 30/93	28-44-33		414	Mar 30/01
28-44-31		401	Mar 30/01	28-44-33		415	Mar 30/01
28-44-31		402	Mar 30/01	28-44-33		416	Mar 30/01
28-44-31		403	Mar 30/01	28-44-33		417	Mar 30/01
28-44-31		404	Mar 30/01	28-44-33		418	Mar 30/01
28-44-31		405	Mar 30/01	28-44-33		419	Mar 30/01
28-44-31		406	Mar 30/01	28-44-33		420	Mar 30/01
28-44-31		407	Mar 30/01	28-44-33		421	Mar 30/01
28-44-31		408	Mar 30/01	28-44-33		422	Mar 30/01
28-44-31		409	Mar 30/01	28-44-33		423	Mar 30/01
28-44-31		410	Mar 30/01	28-44-33		424	Mar 30/01
28-44-31		411	Mar 30/01	28-44-33		425	Mar 30/01
28-44-31		412	Mar 30/01	28-44-33		426	Mar 30/01
28-44-31		413	Mar 30/01	28-44-33		427	Mar 30/01
28-44-31		414	Mar 30/01	28-44-33		428	Mar 30/01
28-44-31		415	Mar 30/01	28-44-33		429	Mar 30/01
28-44-31		416	Mar 30/01	28-44-51		401	Aug 30/80
28-44-31		417	Mar 30/01	28-44-51		402	Aug 30/80
28-44-31		418	Mar 30/01	28-44-51		403	Aug 30/80
28-44-31		419	Mar 30/01	28-44-51		404	Aug 30/80
28-44-31		420	Mar 30/01	28-44-51		405	Aug 30/80
28-44-31		421	Mar 30/01	28-44-51		406	Aug 30/80
28-44-31		422	Mar 30/01	28-44-51		407	Aug 30/80
28-44-31		423	Mar 30/01	28-44-51		408	Aug 30/80
28-44-31		424	Mar 30/01	28-44-51		409	Aug 30/80

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28-44-51		410	Aug 30/80	28-44-84		401	Nov 30/75
28-44-51		411	Aug 30/80	28-44-84		402	Nov 30/77
28-44-51		412	Aug 30/80	28-44-84		403	Nov 30/77
28-44-51		413	Aug 30/80	28-44-85		401	Aug 30/80
28-44-51		414	Aug 30/80	28-44-85		402	Aug 30/80
28-44-51		415	Aug 30/80	28-44-85		403	Nov 30/79
28-44-51		416	Sep 30/93	28-44-92		401	Jun 30/75
28-44-52		401	Mar 30/01	28-44-92		402	Feb 28/77
28-44-52		402	Mar 30/01	28-44-92		403	Feb 28/77
28-44-52		403	Mar 30/01				
28-44-52		404	Mar 30/01	28-45-00		1	Jun 30/75
28-44-52		405	Mar 30/01	28-45-00		2	Jun 30/75
28-44-52		406	Mar 30/01	28-45-00		3	Jun 30/75
28-44-52		407	Mar 30/01	28-45-00		4	Jun 30/75
28-44-52		408	Mar 30/01	28-45-00		101	Jun 30/75
28-44-52		409	Mar 30/01	28-45-00		102	Jun 30/75
28-44-52		410	Mar 30/01	28-45-00		103	Jun 30/75
28-44-52		411	Mar 30/01	28-45-00		104	Jun 30/75
28-44-52		412	Mar 30/01	28-45-00		105	Nov 30/79
28-44-52		413	Mar 30/01	28-45-00		106	Nov 30/79
28-44-52		414	Mar 30/01	28-45-00		501	Jun 30/75
28-44-52		415	Mar 30/01	28-45-00		502	Aug 30/75
28-44-52		416	Mar 30/01	28-45-00		503	Aug 30/75
28-44-52		417	Mar 30/01	28-45-00		504	Aug 30/75
28-44-52		418	Mar 30/01	28-45-11		401	Nov 30/78
28-44-71		401	Mar 30/01	28-45-11		402	Nov 30/78
28-44-71		402	Mar 30/01	28-45-12		401	May 30/76
28-44-71		403	Mar 30/01	28-45-12		402	May 30/76
28-44-71		404	Mar 30/01	28-45-12		403	Jun 30/75
28-44-71		405	Mar 30/01	28-45-12		404	May 30/76
28-44-71		406	Mar 30/01	28-45-12		405	Jun 30/76
28-44-71		407	Mar 30/01	28-45-12		406	May 30/76
28-44-71		408	Mar 30/01	28-45-12		407	May 30/76
28-44-71		409	Mar 30/01				
28-44-71		410	Mar 30/01	28-46-00		1	Mar 31/95
28-44-71		411	Mar 30/01	28-46-00		2	Mar 31/95
28-44-71		412	Mar 30/01	28-46-00		3	Mar 31/95
28-44-71		413	Mar 30/01	28-46-00		4	Nov 30/76
28-44-71		414	Mar 30/01	28-46-00		101	Jun 30/75
28-44-71		415	Mar 30/01	28-46-00		102	Jun 30/75
28-44-71		416	Mar 30/01	28-46-00		103	Jun 30/75
28-44-81		401	Aug 30/76	28-46-00		104	Jun 30/75
28-44-81		402	Feb 28/77	28-46-00		105	Jun 30/75
28-44-81		403	Aug 30/76	28-46-00		106	Jun 30/75
28-44-82		401	Mar 30/01	28-46-00		107	Mar 31/95
28-44-82		402	Mar 30/01	28-46-00		401	Mar 31/95
28-44-83		401	Mar 30/01	28-46-00		402	Mar 31/95
28-44-83		402	Mar 30/01	28-46-00		403	Mar 31/95
28-44-83		403	Mar 30/01	28-46-00		501	Mar 31/95
28-44-83		404	Mar 30/01	28-46-00		502	Dec 15/93

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28-46-00		503	Aug 30/75
28-46-21		401	Nov 30/77
28-46-21		402	Aug 30/76
28-46-21		403	Aug 30/76
28-46-21		404	Mar 31/98
28-46-21		405	Aug 30/76
28-46-21		406	Aug 30/76
28-46-31		401	Mar 31/95
28-46-31		402	May 30/81

SERVICE BULLETIN LIST

In the following service bulletin list, SB indicates an aircraft manufacturers bulletin, AEB indicates an airline engineering bulletin and OL indicates an engine manufacturers bulletin (complete identification OL.593-XX-XXX).

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 28-023		Aug 30/78	Embodied
R SB 11-016		May 30/81	Embodied Placards. Flight compartment - To change fuel jettison limitation label
SB 28-001		Nov 30/77	Embodied Fuel. Engine feed system -To introduce modified bellows vibration damping sleeve - LP fuel pipe, upper and lower
SB 28-001	01		Embodied Fuel. Engine feed system -To introduce modified bellows vibration damping sleeve - LP fuel pipe, upper and lower
SB 28-002			Not applicable
SB 28-003			Not applicable
SB 28-004			No effect Fuel level sensing -Introduction of level sensors with improved reliability thermistors
SB 28-004	01		No effect Fuel level sensing -Introduction of level sensors with improved reliability thermistors
SB 28-005			Applicable Fuel trim transfer system -To improve trim pump starting at high altitude with low fuel level
SB 28-006			Embodied Fuel quantity indication -Special check to ensure correct installation of FQI gauges for tanks 9, 10 & 11, on the 3rd crew members (3CM) panel, to avoid jamming of the instrument mechanism
SB 28-007			Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indicators
SB 28-007	01		Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indica-

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			tors
SB 28-007	02		Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indicators
SB 28-007	03		Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indicators
SB 28-007	04		Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indicators
SB 28-007	05		Applicable Fuel -Indicating -To introduce electrically bonded magnetic fluid level indicators
SB 28-008			No effect Fuel -Indicating -Level switch pack, segregation of power and signal lines.
SB 28-008	01		No effect Fuel -Indicating -Level switch pack, segregation of power and signal lines.
SB 28-008	02		No effect Fuel -Indicating -Level switch pack, segregation of power and signal lines.
SB 28-008	03		No effect Fuel -Indicating -Level switch pack, segregation of power and signal lines.
SB 28-009		Feb 28/77	Embodied Fuel -Trim transfer system -To introduce stronger fuel transfer pipes aft of frame 72 in the rear fuselage
SB 28-009	01		No effect Fuel -Trim transfer system -To introduce stronger fuel transfer pipes aft of frame 72 in the rear fuselage
SB 28-009	02		Embodied Fuel -Trim transfer system -To introduce stronger fuel transfer pipes aft of frame 72 in the rear fuselage
SB 28-010			Not applicable
SB 28-011			Applicable Fuel. Vent & pressurization system -To

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			protect the scavenge tank vent drain and return to tank pipes in the equipment bay at frame 73
SB 28-011	01		Applicable Fuel. Vent & pressurization system -To protect the scavenge tank vent drain and return to tank pipes in the equipment bay at frame 73
SB 28-012		Feb 28/79	Embodied Fuel. FQI -Clearance of aft take-off C of G to increase fuel load and to install a revised standard of standby C.G. pack
SB 28-012	01		Embodied Fuel. FQI -Clearance of aft take-off C of G to increase fuel load and to install a revised standard of standby C.G. pack
SB 28-012	02		Embodied Fuel. FQI -Clearance of aft take-off C of G to increase fuel load and to install a revised standard of standby C.G. pack
SB 28-012	03		Embodied Fuel. FQI -Clearance of aft take-off C of G to increase fuel load and to install a revised standard of standby C.G. pack
SB 28-012	04		Embodied Fuel. FQI -Clearance of aft take-off C of G to increase fuel load and to install a revised standard of standby C.G. pack
SB 28-013			Embodied Fuel -Quantity indication -To introduce fuel quantity packs and tank probes with improved temperature compensation and improved comparator settings (Residual voltage)
SB 28-013	01		Embodied Fuel -Quantity indication -To introduce fuel quantity packs and tank probes with improved temperature compensation and improved comparator settings (Residual voltage)
SB 28-013	02		Embodied Fuel -Quantity indication -To introduce fuel quantity packs and tank probes with improved temperature compensation and im-

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			proved comparator settings (Residual voltage)
SB 28-013	03		Embodied Fuel -Quantity indication -To introduce fuel quantity packs and tank probes with improved temperature compensation and improved comparator settings (Residual voltage)
SB 28-013	04		Embodied Fuel -Quantity indication -To introduce fuel quantity packs and tank probes with improved temperature compensation and improved comparator settings (Residual voltage)
SB 28-015			Not applicable
SB 28-016		May 30/77	Embodied Fuel -Level indication -Provision of tank 11 overfull warning with trim valves closed
SB 28-017			Not applicable
SB 28-018		Nov 30/79	Embodied Fuel. Tanks - Improvement to sealing of pressure seals and installation of accessories
R SB 28-018	01		No effect Fuel. Tanks - Improvement to sealing of pressure seals and installation of accessories
SB 28-019			Not applicable
SB 28-020		Nov 30/77	Embodied Fuel -Dump system -Change to master jettison valve system
SB 28-020	01		Embodied Fuel -Dump system -Change to master jettison valve system
SB 28-020	02		Embodied Fuel -Dump system -Change to master jettison valve system
SB 28-020	03		Embodied Fuel -Dump system -Change to master jettison valve system
SB 28-020	04		Embodied Fuel -Dump system -Change to master jettison valve system
SB 28-020	05		Embodied

SERVICE BULLETIN LIST

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			Fuel -Dump system -Change to master jettison valve system
SB 28-021			No effect
			Fuel quantity indication. Fuel Quantity Packs -Adjustment of servo-loop residual voltages
SB 28-022			Applicable
			Fuel. Engine Feed System -To introduce an improved Heat Exchanger By-pass valve actuator motor
SB 28-022	01		Applicable
			Fuel. Engine Feed System -To introduce an improved Heat Exchanger By-pass valve actuator motor
SB 28-022	02		Applicable
			Fuel. Engine Feed System -To introduce an improved Heat Exchanger By-pass valve actuator motor
SB 28-023			Applicable
			Fuel. Fuel quantity indication -To change existing Arinc standard instrument clamp with new type clamps and change type of refuel control valve switches
SB 28-023	01		Applicable
			Fuel. Fuel Quantity Indication - To change existing Arinc standard instrument clamps with new type clamps and change type of Refuel Control Valve Switches
SB 28-024			Applicable
			Fuel -Addition of de-aeration pipe bracket in tanks 5A and 7A
SB 28-024	01		Applicable
			Fuel -Addition of de-aeration pipe bracket in tanks 5A and 7A
SB 28-025			Not applicable
SB 28-026		Feb 28/77	Embodied
			Fuel indication. To prevent cross mating of connectors to electronic packs
SB 28-026	01		Embodied
			Fuel indication. To prevent cross mating of connectors to electronic packs
SB 28-026	02		Applicable
			Fuel indication. To prevent cross mating of connectors to electronic packs

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 28-027		Nov 30/77	Embodied Fuel -Vent and dump system -To introduce redesigned fuel pipes and attachments in the tail cone
SB 28-027	01		Applicable Fuel - Vent and dump system - To introduce redesigned fuel pipes and attachments in the tail cone
SB 28-027	02		Applicable Fuel. Vent and dump system - To introduce redesigned fuel pipes and attachments in the tail cone
SB 28-027	03		Applicable Fuel -Vent and dump system -To introduce redesigned fuel pipes and attachments in the tail cone
SB 28-027	04		Applicable Fuel -Vent and dump system -To introduce redesigned fuel pipes and attachments in the tail cone
SB 28-029			No effect Fuel. Sensing line adaptors-To introduce an improvement to prevent bottoming on the pressure switch flame trap screw
SB 28-029	01		Embodied Fuel. Sensing line adaptors-To introduce an improvement to prevent bottoming on the pressure switch flame trap screw
SB 28-030			No effect Fuel quantity indication -To introduce a change of main C.G. pack as trial installation to investigate spurious operation of failure flag on total contents indicator (TCI)
SB 28-030	01		No effect Fuel quantity indication -To introduce a change of main C.G. pack as trial installation to investigate spurious operation of failure flag on total contents indicator (TCI)
SB 28-031			Not applicable
SB 28-031	01		Not applicable
SB 28-031	02		Not applicable
SB 28-032			Applicable

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			Fuel, vent and pressurization system -To change the installation of the tank pressurization system in the fin
SB 28-032	01		Applicable
			Fuel, vent and pressurization system -To change the installation of the tank pressurization system in the fin
SB 28-032	02		Applicable
			Fuel - Vent and Pressurization System - To change the installation of the tank pressurization system in the fin
SB 28-032	03		Applicable
			Fuel - Vent and Pressurization System - To change the installation of the tank pressurization system in the fin
SB 28-033			No effect
			Fuel. Main centre of gravity pack -To prevent spurious operation of total fuel contents indicator failure flag
SB 28-034			No effect
			Fuel -Engine feed system -To change the fuel/air differential pressure switches
SB 28-034	01		No effect
			Fuel -Engine feed system -To change the fuel/air differential pressure switches
SB 28-035		Aug 30/78	Embodied
			Fuel. Refuel pressure switches-To change the setting of the switches
SB 28-036			No effect
			Fuel - Replacement of level sensing probes
SB 28-036	01		Applicable
			Fuel -Replacement of level sensing probes
SB 28-036	02		Applicable
			Fuel -Replacement of level sensing probes
SB 28-036	03		Applicable
			Fuel -Replacement of level sensing probes
SB 28-037			No effect
			Fuel. Modify and add fuel pipe supports to improve reliability of installation in zone of spars 51, 54 and 60
SB 28-037	01		No effect
			Fuel. Modify and add fuel pipe supports to improve reliability of installation in zone

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			of spars 51, 54 and 60
SB 28-039			Applicable Fuel. Transfer control valve -Modified to limit surge pressures
SB 28-040		May 30/80	Embodied Fuel. System pressurization pipe in fin - Revised method of pipe identification and improved security of bonding leads
SB 28-041			Embodied Fuel. Main transfer -To improve locking of fuel pipe couplings in underfloor dry bay, frames 72-81, Zones 153/154
SB 28-042			Applicable Fuel. Tank Pressure Indication - Modification of the Tank Pressure Relief Valve Indication circuit
SB 28-042	01		Applicable Fuel. Tank pressure indication - Modification of the tank pressure relief valve indication circuit
SB 28-042	02		Applicable Fuel - Tank Pressure Indication - Modification of the Tank Pressure Relief Valve Indication circuit
SB 28-042	03		Embodied Fuel - Tank Pressure Indication - Modification of the Tank Pressure Relief Valve Indication circuit
SB 28-043			Applicable Fuel -Dual channel quantity indicating inhibition failure
SB 28-043	01		Applicable Fuel - Dual channel quantity indicating inhibition failure.
SB 28-044			No effect Fuel. Load Limit Control Selectors - To improve reliability
SB 28-045			Applicable Fuel. Fuel Level Indication Sub-System - Revision to the frequency of maintenance task
SB 28-046			Applicable Fuel. F.Q.I. Control Panel - To introduce a new standard of panel

SERVICE BULLETIN LIST

	SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
	SB 28-047		Aug 30/77	Embodied Fuel. Sensors - To introduce modified fuel tank and scavenge pump level sensors
	SB 28-047	01		Applicable Fuel. Sensors - To introduce modified fuel tank and scavenge pump level sensors
	SB 28-047	02		Applicable Fuel. Sensors - To introduce modified fuel tank and scavenge pump level sensors
	SB 28-047	03		No effect Fuel. Sensors - To introduce modified fuel tank and scavenge pump level sensors
	SB 28-048		May 30/79	Embodied Fuel : trim transfer system - To introduce pulse start control to the four forward trim pumps
	SB 28-048	01		Embodied Fuel : trim transfer system - To introduce pulse start control to the four forward trim pumps
	SB 28-048	02		Embodied Fuel : trim transfer system - To introduce pulse start control to the four forward trim pumps
	SB 28-048	03		No effect Fuel : trim transfer system - To introduce pulse start control to the four forward trim pumps
	SB 28-048	04		No effect Fuel : trim transfer system - To introduce pulse start control to the four forward trim pumps
	SB 28-048	02	Feb 29/80	Embodied
	SB 28-049			Not applicable
	SB 28-050			Not applicable
R	SB 28-051			No effect Fuel. Add mounting bracket to wiring routing near Tank 5 pressure relief valve.
R	SB 28-051	01		No effect Fuel. Add mounting bracket to wiring routing near Tank 5 pressure relief valve.
	SB 28-052			Not applicable
	SB 28-053		May 30/80	Embodied Fuel - Vent Pipe - To extend the life of the

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			fuel vent pipe support ring
SB 28-053	01		No effect Fuel. Vent system - To extend life of fuel vent pipe (RH) support ring
SB 28-054			Applicable Fuel - Recirculation Control Valve - Inspection for cracks adjacent to swaged thread inserts in manifold
SB 28-054	01		Applicable Fuel - Recirculation Control Valve - Inspection for cracks adjacent to swaged thread inserts in manifold
SB 28-055			No effect Fuel. Mach Centre of Gravity (C.G.) - To provide inhibition of boundary warnings when selected to a failed C.G. channel.
SB 28-055	01		No effect Fuel. Mach Centre of Gravity (C.G.) - To provide inhibition of boundary warnings when selected to a failed C.G. channel.
SB 28-056		Feb 29/80	Embodied Fuel. Fuel Quantity Indication - To provide warning of Dual Channel Gauging System doubl failure.
SB 28-056	01		No effect Fuel. Fuel Quantity Indication - To provide warning of Dual Channel Gauging System doubl failure.
SB 28-057			Not applicable
SB 28-058			No effect Fuel - Tanks - Provide sealant repair scheme for canted panel/lower skin panel junction fittings at spars 54 and 60.
SB 28-058	01		No effect Fuel - Tanks - Provide sealant repair scheme for canted panel/lower skin panel junction fittings at spars 54 and 60.
SB 28-059			No effect Fuel - Tanks - Provide sealant repair scheme for canted panel/lower skin panel junction fittings at spars 40 and 41.
SB 28-059	01		Embodied Fuel - Tanks - Provide sealant repair scheme for canted panel/lower skin panel junction

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
			fittings at spars 40 and 41.
SB 28-060			No effect Fuel - Tanks - Provide sealant repair scheme for upper and lower skin panel-to-leading edge rib section junctions
SB 28-061			No effect Fuel Tanks - Provide sealant repair scheme for skin panel-to-spars 61 thru 69 on each side of rib 12.
SB 28-062			Not applicable
SB 28-063		Aug 30/80	Embodied Fuel - Fitment of a restrictor to the Electro - Valves of hydraulic circuits for Tank 11 transfer.
SB 28-063	01		No effect Fuel - Tank 11 - Install restrictor in hydraulic selector valves
SB 28-064			No effect Fuel - Hydraulic driven trim transfer pump-revision to the maintenance task.
SB 28-065			No effect Fuel. Recirculation control valve - Retention device to prevent a large fuel leak in event of failure at circlip groove
SB 28A014			Applicable Fuel -Main transfer system -Inspection of pipes
SB 28A014	01		Applicable Fuel -Main transfer system -Inspection of pipes
SB 28A014	02		Applicable Fuel -Main transfer system -Inspection of pipes
SB 28A014	03		Applicable Fuel -Main transfer system -Inspection of pipes
SB 28A028			No effect Fuel -Differential pressure switches - Omission of central socket cap head screw from the flame trap plate
SB 28A038			No effect Fuel. Refuelling system -Inspection of 5A and 7A refuel pipes and attachments in Tanks 6 and 7

SERVICE BULLETIN LIST

SB/AEB NO	REV	INC. IN REVISION	DESCRIPTION
SB 28A038	01		No effect Fuel. Refuelling System - Inspection of Tanks 5A and 7A refuel pipes and attachments in Tanks 6 and 7
SB 28A038	02		No effect Fuel. Refuelling System - Inspection of Tanks 5A and 7A refuel pipes and attachments in Tanks 6 and 7
SB 32-079		May 30/81	Embodied Landing gear - Install main landing gear tyre underinflation detection system
SB 33-003		Aug 30/77	Embodied Lighting. Tail anti-collision and navigation lights -Deletion of inhibition during fuel jettison
SB 53-042		May 30/80	Embodied Fuselage - Immobilize refuel control unit and toilet service doors in open position with clips
SB 53-042	01	Aug 30/80	Embodied Fuselage - Immobilize refuel control unit and toilet service doors in open position with clips
SB 71-006		Nov 30/77	Embodied Power plant. Heatshields -To protect engine bay pipes against fretting at secondary cross over heatshield attachments

CHAPTER 28

FUEL

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Adjustment/Test			501	ALL
General			501	ALL
Operational Test - Pump Element			501	ALL
Leakage Test - Pump Canister and Engine Feed Pipe			504	ALL
Functional Test - Pump Non-return Valve			507	ALL
Leakage Test - Pump Non-return Valve			507	ALL
PRESSURE SWITCH UNIT (ACCUMULATOR)	28-21-14			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
PUMP PRESSURE SWITCH	28-21-15			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Leakage Test			502	ALL
RECIRCULATION PRESSURE HOLDING VALVE	28-21-16			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Canister			403	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Valve Condition Test			502	ALL
Leakage Test			503	ALL
CROSS-FEED VALVE	28-21-17			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Isolation Canister			406	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
Leakage Test - Valve Element			504	ALL
R Leakage Test - Isolation Canister			505	ALL

SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
ENGINE INLET FUEL PIPE	28-21-18			
Removal/Installation			401	ALL
General			401	ALL
Pipe - Engine 1 or 3			401	ALL
Pipe - Engine 2 or 4			409	ALL
Expansion Coupling Seal Renewal			419	ALL
Adjustment/Test			501	ALL
General			501	ALL
Leakage Test - Using Engine Feed Pumps			501	ALL
Leakage Test - Using Fuel Pressure			503	ALL
Test rigs				
BY-PASS VALVE	28-21-41			
Removal/Installation			401	ALL
General			401	ALL
By-pass Valve Gearbox and Motor			401	ALL
Motor			406	ALL
By-pass Valve			408	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
DRAIN VALVE	28-21-42			
Removal/Installation			401	ALL
General			401	ALL
Drain Valve			401	ALL
LP ISOLATION VALVE	28-21-43			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Canister			405	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Leakage Test - Isolation			505	ALL
Canister			505	ALL
RECIRCULATION LP CONTROL VALVE	28-21-44			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Filter/Non-return Valve			404	ALL
Recirculation LP Control Valve			405	ALL
General			413	ALL
Brace Assembly			413	ALL
Valve Element			416	ALL
Filter/Non-return Valve			419	ALL
Recirculation LP Control Valve			420	ALL
Adjustment/Test			501	ALL
General			501	ALL
Recirculation Control Valve			501	ALL

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	SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
	RECIRCULATION NON-RETURN VALVE	28-21-45			
	Removal/Installation			401	ALL
	General			401	ALL
	Non-return Valve			401	ALL
	Adjustment/Test			501	ALL
	General			501	ALL
	Functional Test			501	ALL
	Leakage Test			503	ALL
	MAIN TRANSFER SYSTEM	28-22-00			
	Description and Operation			1	ALL
	General			1	ALL
	Pump Unit (Tanks 5, 6, 7 and 8)			2	ALL
	Pump Unit (Tanks 5A and 7A)			6	ALL
	Interconnect Valve			6	ALL
	Non-return Valve (Tanks 5A and 7A)			8	ALL
	Transfer Control Valve and Sensor			8	ALL
	Solenoid Valve			13	ALL
	Transfer Shut-off Valve			13	ALL
	Pump Pressure Switch			14	ALL
	Operation			14	ALL
	Electrical Power Supplies			21	ALL
	Trouble Shooting			101	ALL
	General			101	ALL
	Preparation			101	ALL
	Trouble Shooting - Transfer Pumps			103	ALL
	Trouble Shooting - Transfer Shut-off Valves			105	ALL
	Trouble Shooting - Interconnect Valves			107	ALL
	Trouble Shooting - Transfer Control Valves (NORM - AFT TRIM)			108	ALL
	Adjustment/Test			501	ALL
	General			501	ALL
	Operational Test - Main System			501	ALL
	Operational Test - Tanks 5 and 7 Pumps (Emergency Selection)			504	ALL
	Operational Test - Interconnect Valves			505	ALL
R	Operational Test - Underfull Inhibit - (Tanks 1 and 4)			506	ALL
R	Functional Test - Transfer Shut-off Levels (Tanks 1 and 4)			507	ALL
R R	Main Transfer Pipe Leakage Test - Tanks 5, 6, 7 and 8			510	ALL

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	SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
	Functional Test (Sensor Leakage)			512	ALL
	Functional Test (System Leakage) - System Downstream of Transfer Control Valve or Transfer Shut-off Valve			515	ALL
	System Flow Rate Test			517	ALL
	Interconnect Valve Flow Test			519	ALL
	Approved Repairs			801	ALL
B	Repair Scheme K-28-40708			801	ALL
B	Repair Scheme 41272			801	ALL
	SENSOR (TRANSFER CONTROL VALVE)	28-22-11			
	Removal/Installation			401	ALL
	General			401	ALL
	Sensor			401	ALL
	Adjustment/Test			501	ALL
	General			501	ALL
	Functional Test			502	ALL
	Leakage Test			505	ALL
	TRANSFER CONTROL VALVE	28-22-12			
	Removal/Installation			401	ALL
	General			401	ALL
	Valve Element			401	ALL
	Valve Body (without Filter) - Tanks 5 and 7, and Tank 8 (Rear and Outboard)			405	ALL
	Valve Body (with Filter) Tank 2 and Tank 8 (Forward)			413	ALL
	De-aeration Filter (Tank 2 and Tank 8, Forward)			422	ALL
	Adjustment/Test			501	ALL
	General			501	ALL
	Functional Test			502	ALL
	Leakage Test - Tank 2 Valve			505	ALL
	Leakage Test - Tank 5 or 8 Outboard Valve			506	ALL
	Leakage Test - Tank 5 Inboard Valve			507	ALL
	Leakage Test - Tank 7 Valve			508	ALL
	Leakage Test - Tank 8 Inboard Valve			509	ALL
	SOLENOID VALVE - (LEVEL SENSORS)	28-22-13			
	Removal/Installation			401	ALL
	General			401	ALL
	Solenoid Assembly			401	ALL
	Solenoid Valve			406	001-004,
	Solenoid Valve			406	005-007,
	Adjustment/Test			501	ALL
	General			501	ALL
	Functional Test			501	ALL
	Leakage Test			504	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
PUMP UNITS (TANKS 5, 6, 7 AND 8)	28-22-21			
Removal/Installation			401	ALL
General			401	ALL
Pump Element			401	ALL
Isolation Canister			407	ALL
Flap Relief Valve			414	ALL
R Non-return Valve			417	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Pump Element			501	ALL
Functional Test - Isolation Canister			503	ALL
Leakage Test - Isolation Canister			503	ALL
PUMP UNITS (TANKS 5A AND 7A)	28-22-22			
Removal/Installation			401	ALL
General			401	ALL
Pump Element			401	ALL
Pump Mounting Plate			405	ALL
Adjustment/Test			501	ALL
General			501	ALL
Pump Element			501	ALL
Pump Mounting Plate			502	ALL
PUMP PRESSURE SWITCH	28-22-23			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Leakage Test			502	ALL
INTERCONNECT VALVE	28-22-24			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Motor			405	ALL
Canister			406	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Flow Test - Valve			502	ALL
Leakage Test - Valve Canister			503	ALL
NON-RETURN VALVE	28-22-25			
Removal/Installation			401	ALL
General			401	ALL
Non-return Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Leakage Test			502	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
TRANSFER SHUT-OFF VALVE	28-22-26			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Motor			405	ALL
Canister			406	ALL
Adjustment/Test			501	ALL
General			501	ALL
Transfer Shut-off Valve - Operational Test			501	ALL
Transfer Shut-off Valve - Functional Test			502	ALL
Canister - Tank 5A-5 - Leakage Test			503	ALL
Canister - Tank 7A-7 - Leakage Test			505	ALL
TRIM TRANSFER SYSTEM	28-23-00	01		
Description and Operation			1	001-005,
General			1	001-005,
Trim Transfer Pump - Electrically Driven			5	001-005,
Pressure-holding Non-return Valve			7	001-005,
Trim Transfer Pump - Hydraulically Driven			7	001-005,
Hydraulic Fuel Transfer Pump Drive Motor			10	001-005,
Hydraulic Selector Valve			12	001-005,
Inlet Valve			14	001-005,
Pump Pressure Switch			14	001-005,
Pump Start Control Unit			14	001-005,
Operation			16	001-005,
Electrical Power Supplies			30	001-005,
TRIM TRANSFER SYSTEM	28-23-00	02		
Description and Operation			1	006-007,
General			1	006-007,
Trim Transfer Pump - Electrically Driven			4	006-007,
Pressure-holding Non-return Valve			6	006-007,
Trim Transfer Pump - Hydraulically Driven			8	006-007,
Hydraulic Fuel Transfer Pump Drive Motor			10	006-007,
Hydraulic Selector Valve			10	006-007,
Inlet Valve			13	006-007,
Pump Pressure Switch			14	006-007,
Pump Start Control Unit			14	006-007,
Operation			16	006-007,
Electrical Power Supplies			30	006-007,

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
TRIM TRANSFER SYSTEM	28-23-00			
Trouble Shooting			101	ALL
General			101	ALL
Preparation			102	ALL
Trouble Shooting - Trim Inlet Valves			104	ALL
Trouble Shooting - Trim Pumps			106	ALL
Trouble Shooting - Auto Trim Transfer			116	ALL
Trouble Shooting - Load Limit Control - Zero Locking Inhibition			126	ALL
Removal/Installation			401	ALL
General			401	ALL
Compression Seal Coupling			402	ALL
R System Pipes (Frames 72 to 77)			408	ALL
System Pipes (Frames 78 to 81)			415	ALL
System Pipes (Tank 11)			421	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test - Standby Inlet Valves			504	ALL
Operational Test - Trim Valve Standby Motors			505	ALL
Operational Test - Manual Control of Forward and Rearward Trim Transfer			509	ALL
Operational Test - Tank 11 LH Pump De-air Mode Inhibit			512	ALL
Operational Test - Auto-reset of T/O CG Switch			513	ALL
Operational Test - Auto-reset of T/O CG Switch (including Trim Pumps Start Control Unit)			515	ALL
Operational Test - Automatic Forward Trim Override			517	ALL
After SB 28-048: Functional Test - Pumps Start Control Units			519	ALL
Functional Test - Automatic Trim Transfer			522	ALL
Functional Test - Load Limit Control, Zero Locking Inhibition			528	ALL
Functional Test - Trim Valves, High Level Shut-off			530	ALL
Flow Test - Trim Transfer System			533	ALL
Trim Pipes Leakage Test - Zone 153/4			537	ALL
Pipeline Leakage Test			540	ALL
Alternative - Pipeline Leakage Check Using Front Trim Pumps			542	ALL
Approved Repairs			801	ALL
General			801	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
INLET VALVE (TRIM TRANSFER)	28-23-21			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Twin Motor Unit			406	ALL
Canister			407	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Functional Test - Valve Element (Tank 11, LH)			505	ALL
Leakage Test - Valve Canister			506	ALL
THERMAL RELIEF VALVE	28-23-22			
Removal/Installation			401	ALL
General			401	ALL
Thermal Relief Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
PUMP UNIT (ELECTRICAL)	28-23-31			
Removal/Installation			401	ALL
General			401	ALL
Pump Element			401	ALL
Canister			406	ALL
Canister Non-return Valve			416	ALL
Canister Relief Valve (Vapour Vent)			417	ALL
R Canister Pressure Relief Valve			418	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Pump Element			501	ALL
Functional Test - Isolation Canister			502	ALL
Operational Test - Pressure Relief Valve			504	ALL
Functional Test - Pressure Relief Valve			505	ALL
PUMP PRESSURE SWITCH (TANKS 9 AND 10)	28-23-32			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
HYDRAULIC SELECTOR VALVE	28-23-41			
Removal/Installation			401	ALL
General			401	ALL
Hydraulic Selector Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
PUMP UNIT (HYDRAULIC) TANK 11	28-23-51			
Removal/Installation			401	ALL
General			401	ALL
Hydraulic Motor			401	ALL
Pump Element			405	ALL
Canister			408	ALL
Canister Flap Valve (Vapour Vent)			413	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Pump Element			501	ALL
Functional Test - Isolation Canister			502	ALL
PUMP PRESSURE SWITCH (TANK 11)	28-23-52			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
PUMP UNIT (ELECTRICAL) - TANK 11	28-23-53			
Removal/Installation			401	ALL
General			401	ALL
Pump Element			401	ALL
Canister			405	ALL
R Flap Relief Valve			411	ALL
Non-return Valve			413	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test - Pump Eelement			501	ALL
Functional Test - Canister			502	ALL
Leakage Test - Canister			503	ALL
ELECTRIC PUMP PRESSURE SWITCH (TANK 11)	28-23-54			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
PRESSURE HOLDING NON-RETURN VALVE (TANK 11)	28-23-55			
Removal/Installation			401	ALL
General			401	ALL
Non-return Valve			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
LOAD LIMIT CONTROL SELECTOR	28-23-71			
Removal/Installation			401	ALL
General			401	ALL
Load Limit Control Selector			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test (Tank 9 + 10 Selector)			501	ALL
Operational Test (Tank 11 Selector)			503	ALL
FUEL TRIM PUMP START CONTROL UNIT	28-23-72			
After SB 28-048: Removal/Installation			401	001-005,
Removal/Installation			401	006-007,
General			401	ALL
Pump Start Control Unit			401	ALL
After SB 28-048: Adjustment/Test			501	001-005,
Adjustment/Test			501	006-007,
General			501	ALL
Operational Test			501	ALL
Functional Test			504	ALL
REFUEL	28-24-00			
Description and Operation			1	ALL
General			1	ALL
Refuel Control Unit			1	ALL
Refuel Tank Inlet Valve			5	ALL
Refuel Protection Pressure Switch			7	ALL
Load Limit Control Selectors			8	ALL
Refuel Panel Door Microswitch			8	ALL
Operation			10	ALL
Electrical Power Supplies			20	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			102	ALL
Trouble Shooting - Refuel Switching			105	ALL
Trouble Shooting - Load Limit Control, Operational Test			117	ALL
Trouble Shooting - Overbalance Protection			123	ALL
Trouble Shooting - Overpressure Protection			125	ALL
Trouble Shooting - Tank Refuelling Rate, Including High Level Shut-off and Overfull Shut-off			128	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
Removal/Installation			401	ALL
General			401	ALL
Refuel Panel Access Door Change-over Relay			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Refuelling Control(s) - Functional Test			502	ALL
Load Limit Control - Functional Test			509	ALL
Overbalance Protection - Functional Test			515	ALL
Overpressure Protection - Functional Test			518	ALL
Refuelling Rate, High Level Shut-off and Overfull Shut-off - Functional Test			521	ALL
Approved Repairs			801	ALL
General			801	ALL
REFUEL TANK INLET VALVE (1 in)	28-24-11			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Motor			405	ALL
Canister - Tanks 2, 3 and 7			406	ALL
Canister - Tanks 5A and 7A			413	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Leakage Test - Valve Element			503	ALL
Leakage Test - Valve Canister			504	ALL
REFUEL TANK INLET VALVE (2 in) WITH NON-RETURN VALVE	28-24-12			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Motor			405	ALL
Canister (Tanks 1, 4, 5, 6 and 8)			406	ALL
Canister (Tanks 9 and 10)			409	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Leakage Test - Valve Element, including Non-return Valve			504	ALL
Leakage Test - Valve Canister			505	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
REFUEL CONTROL UNIT	28-24-21			
Removal/Installation			401	ALL
General			401	ALL
Refuel Control Unit			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Leakage Test			503	ALL
REFUELLING ADAPTER	28-24-22			
Inspection/Check			601	ALL
General			601	ALL
Equipment and Materials			601	ALL
Checking Adapter Slot Width			601	ALL
Checking Adapter Lug Thickness			602	ALL
Checking Adapter Lug Width			602	ALL
REFUEL PROTECTION PRESSURE SWITCH	28-24-23			
Removal/Installation			401	ALL
General			401	ALL
Refuel Protection Pressure Switch			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test (Procedure 1)			501	ALL
Functional Test (Procedure 2)			504	ALL
Leakage Test			506	ALL
LOAD LIMIT CONTROL SELECTOR	28-24-51			
Removal/Installation			401	ALL
General			401	ALL
Load Limit Control Selector			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
REFUEL PANEL DOOR MICROSWITCH	28-24-61			
Removal/Installation			401	ALL
General			401	ALL
Refuel Panel Door Microswitch and Actuating Lever			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Microswitch Actuating Lever Adjustment			502	ALL
TANK PRESSURE RELIEF VALVE INDICATION SELECTOR SWITCH	28-24-62			
Removal/Installation			401	ALL
General			401	ALL
TPRV Selector Switch			401	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
DEFUEL	28-25-00			
Description and Operation			1	ALL
General			1	ALL
Operation			1	ALL
Servicing			301	ALL
General			301	ALL
Safety Regulations			301	ALL
Defuelling Limitations			302	ALL
Complete Defuelling			303	ALL
Partial Defuelling			310	ALL
Over-wing Defuelling			315	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Defuelling Rate			501	ALL
Approved Repairs			801	ALL
General			801	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
DUMP SYSTEM	28-31-00			
Description and Operation			1	ALL
General			1	ALL
Collector Tank Jettison Valve			1	ALL
Master Jettison Valve			4	ALL
Valve Control Relay			6	ALL
Interlock Relay			6	ALL
Operation			6	ALL
Electrical Power Supplies			9	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting - Collector Tank Jettison Valve			104	ALL
Trouble Shooting - Master Jettison Valve			105	ALL
Trouble Shooting - Auto Shut-off			107	ALL
Removal/Installation			401	ALL
General			401	ALL
Preparation			401	ALL
Pipe F89-90			403	ALL
Pipe F90-91			411	ALL
Pipe F91-93			415	ALL
Pipe F93-95			417	ALL
Pipe F95-96			421	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Auto Shut-off Functional Test			503	ALL
Approved Repairs			801	ALL
General			801	ALL
Simple Crack			801	ALL
Multiple Cracks			805	ALL
Pipe and Diaphragm Crack			806	ALL
Diaphragm Crack			809	ALL
Flange Cracks			813	ALL
COLLECTOR TANK JETTISON VALVES	28-31-11			
Removal/Installation			401	ALL
General			401	ALL
Valve Element			401	ALL
Valve Motor			405	ALL
Valve Canister - Tank 1 or 4			406	ALL
Valve Canister - Tank 2 or 3			410	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test - Valve Element			501	ALL
Leakage Test - Valve Element			502	ALL
Leakage Test - Valve Canister			503	ALL
Flow Test - Valve			506	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
MASTER JETTISON VALVES	28-31-32			
Removal/Installation			401	ALL
General			401	ALL
Master Jettison Valve			401	ALL
Motor Valve			407	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
Leakage Test			503	ALL
Flow Test			506	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
INDICATING	28-40-00			
Description and Operation			1	ALL
General			1	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			502	ALL
Functional Test			505	ALL
LEAKAGE	28-41-00			
Description and Operation			1	ALL
General			1	ALL
Float Switch			1	ALL
Operation			1	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			103	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
FLOAT SWITCH	28-41-11			
Removal/Installation			401	ALL
General			401	ALL
Float Switch			401	ALL
LEVEL INDICATION	28-42-00			
Description and Operation			1	ALL
General			1	ALL
Sensors			1	ALL
Level Switching Packs			1	ALL
Level Switching Channels			4	ALL
Operation			4	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Functional Test			503	ALL
LEVEL SWITCHING PACKS	28-42-51			
Removal/Installation			401	ALL
General			401	ALL
Level Switching Pack			401	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
ENGINE FEED LOW PRESSURE INDICATION	28-43-00			
Description and Operation			1	ALL
General			1	ALL
Pressure Switch			1	ALL
Operation			1	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
PRESSURE SWITCH (ENGINE INLET)	28-43-11			
Removal/Installation			401	ALL
General			401	ALL
Pressure Switch			401	ALL
FUEL QUANTITY INDICATION	28-44-00			
Description and Operation			1	ALL
General			1	ALL
Probes			2	ALL
Quantity Packs			5	ALL
CG Packs			7	ALL
Contents Indicators			8	ALL
Load Limit Selectors			9	ALL
CG Indicators			16	ALL
FQI Control Panel			17	ALL
Operation			18	ALL
Electrical Power Supplies			25	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			102	ALL
Removal/Installation			401	ALL
General			401	ALL
Caption Light Module			401	ALL
54% T/O CG Selector Switch			405	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Functional Test			511	ALL
PROBES, TANKS 1 AND 4	28-44-11			
Removal/Installation			401	ALL
General			401	ALL
Probes			402	ALL
PROBES, TANKS 2 AND 3	28-44-12			
Removal/Installation			401	ALL
General			401	ALL
Probes			401	ALL

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	SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
	PROBES, TANKS 5 AND 8	28-44-31			
	Removal/Installation			401	ALL
	General			401	ALL
	Probe			402	ALL
	PROBES, TANKS 5A AND 7A	28-44-32			
	Removal/Installation			401	ALL
	General			401	ALL
	Probes			401A	ALL
	PROBES, TANKS 6 AND 7	28-44-33			
	Removal/Installation			401	ALL
	General			401	ALL
	Probes			402A	ALL
	PROBES, TANK 9	28-44-51			
	Removal/Installation			401	ALL
	General			401	ALL
	Probes			401	ALL
	PROBES, TANK 10	28-44-52			
	Removal/Installation			401	ALL
	General			401	ALL
R	Probes			405	ALL
	PROBES, TANK 11	28-44-71			
	Removal/Installation			401	ALL
	General			401	ALL
R	Probes			405	ALL
	CG PACKS	28-44-81			
	Removal/Installation			401	ALL
	General			401	ALL
	CG Packs			401	ALL
	FQI CONTROL PANEL	28-44-82			
	Removal/Installation			401	ALL
	General			401	ALL
	FQI Control Panel			401	ALL
	FUEL CONTENTS INDICATORS	28-44-83			
	Removal/Installation			401	ALL
	General			401	ALL
	Fuel Contents Indicators			401	ALL
	FUEL TOTALISER (TOTAL CONTENTS) INDICATORS	28-44-84			
	Removal/Installation			401	ALL
	General			401	ALL
	Fuel Totaliser Indicators			401	ALL
	CG INDICATORS	28-44-85			
	Removal/Installation			401	ALL
	General			401	ALL
	CG Indicators			401	ALL
	QUANTITY PACKS	28-44-92			
	Removal/Installation			401	ALL
	General			401	ALL
	Quantity Packs			401	ALL

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SUBJECT	CH/SE/SU	C	PAGE	EFFECTIV
FUEL TEMPERATURE INDICATION	28-45-00			
Description and Operation			1	ALL
General			1	ALL
Sensor			1	ALL
Indicator			1	ALL
Operation			1	ALL
System Management			3	ALL
Electrical Power Supplies			4	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			102	ALL
Adjustment/Test			501	ALL
General			501	ALL
Operational Test			501	ALL
Functional Test			501	ALL
FUEL TEMPERATURE INDICATOR	28-45-11			
Removal/Installation			401	ALL
General			401	ALL
Fuel Temperature Indicator			401	ALL
TEMPERATURE SENSOR	28-45-12			
Removal/Installation			401	ALL
General			401	ALL
Temperature Sensor			401	ALL
Sensor Pocket			404	ALL
TANK PRESSURE INDICATION	28-46-00			
Description and Operation			1	ALL
General			1	ALL
Pressure Transducer			1	ALL
Indicator			1	ALL
Operation			2	ALL
Trouble Shooting			101	ALL
General			101	ALL
Preparation			101	ALL
Trouble Shooting			102	ALL
Removal/Installation			401	ALL
General			401	ALL
Caption Light Module			401	ALL
Adjustment/Test			501	ALL
General			501	ALL
Functional Test			501	ALL
TANK PRESSURE TRANSDUCER	28-46-21			
Removal/Installation			401	ALL
General			401	ALL
Tank Pressure Transducer			401	ALL
TANK PRESSURE INDICATOR	28-46-31			
Removal/Installation			401	ALL
General			401	ALL
Tank Pressure Indicator			401	ALL

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GENERAL - DESCRIPTION

1. General (Ref. Fig.001, 002 and 003)

The fuel system stores and delivers fuel to the engines at suitable flow rates, temperatures and pressures for all engine operating conditions. Fuel is used to control and adjust the position of the aircraft centre of gravity as required to match the differing aerodynamic centre positions in subsonic and supersonic flight. The fuel also acts as a heat sink to dissipate heat rejected by the air-conditioning, hydraulic and engine systems.

2. Storage Tanks (Ref. Fig.001 and 002)

Fuel is stored in thirteen tanks, formed as sealed cells, integral with the
R aircraft structure. Six tanks (No. 1, 4, 5, 6, 7 and 8) include liners
R installed on the wing lower surface panels, inboard side (Ref. 57-12-00). The majority of the fuel system components are located in the tanks, are readily accessible and, in most cases, can be removed without draining the tanks.

To prevent fuel vapour entering the cabin, a vapour-seal membrane forms a double skin over the fuselage fuel tank cells. This area is pressurized and vented overboard (Ref. 21-00-00).

The tanks are arranged in three groups. Two groups, the LH and RH main transfer groups, store the bulk of the fuel in the wings and parts of the centre fuselage, both groups have three main tanks supplying two collector tanks from which the engines are fed. A third group, the trim transfer group, stores the remainder of the fuel between two tanks forward in the wings and a single tank in the rear fuselage.

The forward and rear trim tanks are connected by two separate pipes, one passing through the LH wing and the other through the RH wing. These pipes are also used for the routing of trim fuel to the main transfer tanks and for rapidly conveying fuel to and from the tanks during refuelling and defuelling and when jettisoning fuel in flight

3. Venting and Pressurization (Ref. Fig.001)

The fuel tanks are vented by the vent pipe which connects each tank to atmosphere through vents in the rear fuselage. At high altitude, the tanks are pressurized with air from a fin-mounted air intake to facilitate fuel pumping and to prevent fuel boiling. The system is controlled by valves, some mechanically operated by either fuel levels or pressures, others electrically operated under the control of pressure switches or level sensors. Any fuel spilling into the vent

pipes is drained to a scavenge tank and then pumped to a collector tank. Additional tank vents are provided to allow for thermal expansion of fuel. An ignition protection system automatically senses and extinguishes any combustion of fuel vapour at the main atmospheric vents. Bursting discs, fitted at various points in the system, provide protection against overpressure in the vent system.

R 4. Engine Feed (Ref. Fig.002 and 003)

Each engine has its own feed system, fed from a collector tank, to any or all engines. Electrically driven pumps deliver the fuel, under pressure, from the collector tanks to the engines. Fuel accumulators take over from the pumps
R during short periods of 'negative G' condition. Fuel passing through heat exchangers connected in each feed system cools the aircraft hydraulic and air-conditioning systems. When the outlet fuel flow from the heat exchangers exceeds engine requirements, the excess fuel is diverted through recirculation valves and returned to the collector tanks; the returned fuel is dispersed across the bottom of the tanks to ensure maximum cooling.

R 5. Main Transfer (Ref. Fig.002 and 003)

The main transfer system transfers fuel from the main transfer tanks to the collector tanks at a rate which ensures that the collector tanks are either maintained in a near full condition, or the rear tanks near full and the forward tanks controlled at a lower level to finally trim the aircraft for cruise.

The position of the aircraft centre of gravity is kept near constant during these transfers by simultaneously emptying a main tank on one side of the aircraft and a tank on the other side having an equal but opposite pitching moment.

Fuel is transferred from each tank by electrically driven pumps. The pumps are manually controlled to match an automatic sequence of mechanically operated transfer valves which are governed by float sensors in the tanks receiving the fuel.

R 6. Trim Transfer (Ref. Fig.002 and 003)

To keep the aircraft trimmed correctly during transonic acceleration or deceleration, the aircraft centre of gravity
R must be moved rearward or forward. This is done by automatic transference of fuel between front and rear trim tanks and from trim tanks to main transfer tanks. All the pumps in the forward trim tanks, and two of the four pumps in the rear trim tank, are electrically driven but the remaining

two rear pumps are hydraulically driven to ensure that fuel can be transferred forward in the event of an electric power failure.

7. Refuelling (Ref. Fig. 002, 004 and 005)

Refuelling is carried out through two refuel control units, located in the wing lower fairings forward of the main landing gear bays and connected to the trim transfer pipes. All the tanks can be refuelled simultaneously or each tank separately, for either partial or total filling, by operating selector switches on the refuel control panel located next to one of the refuel control units, the required quantities being pre-selected on the refuel control panel. Part or all of the refuelling procedure is stopped in the event of overfilling, excess pressure, inadvertent opening of the trim valves or adverse rearward movement of the aircraft centre of gravity. Refuelling can be carried out either automatically or manually.

R 8. Defuelling (Ref. Fig. 002)

R Defuelling is carried out by using the pumps in the tanks being defuelled. Fuel from the main tanks is transferred to the collector tanks before being discharged, via the trim pipes, together with fuel from the trim tanks, through the refuel control units.

R 9. Jettison (Ref. Fig.002 and 003)

The tank pumps are used to jettison fuel in flight. Fuel is pumped into the trim pipes and then passed into the jettison pipe from where it is discharged overboard. The system ensures that when fuel is being jettisoned, sufficient fuel is retained for operation of the engines by stopping the jettison operating if the fuel in the collector tanks falls to the underfull level. If a main electric power failure occurs, the hydraulic pumps in the rear trim tank continue to jettison fuel from that tank.

R 10. De-aeration (Ref. Fig. 001)

Self-contained de-aeration systems are provided in tanks where fuel remains static for relatively long periods. De-aeration prevents momentary increases in tank pressure, fuel transfer via the vent gallery and formation of air pockets around pump
R inlets. These conditions can occur due to the quantity of air
R in solution in the fuel decreasing as tank pressure falls
R during climb.

De-aeration is carried out by circulating fuel through spray nozzles in the tanks, using either transfer pumps or, in tank

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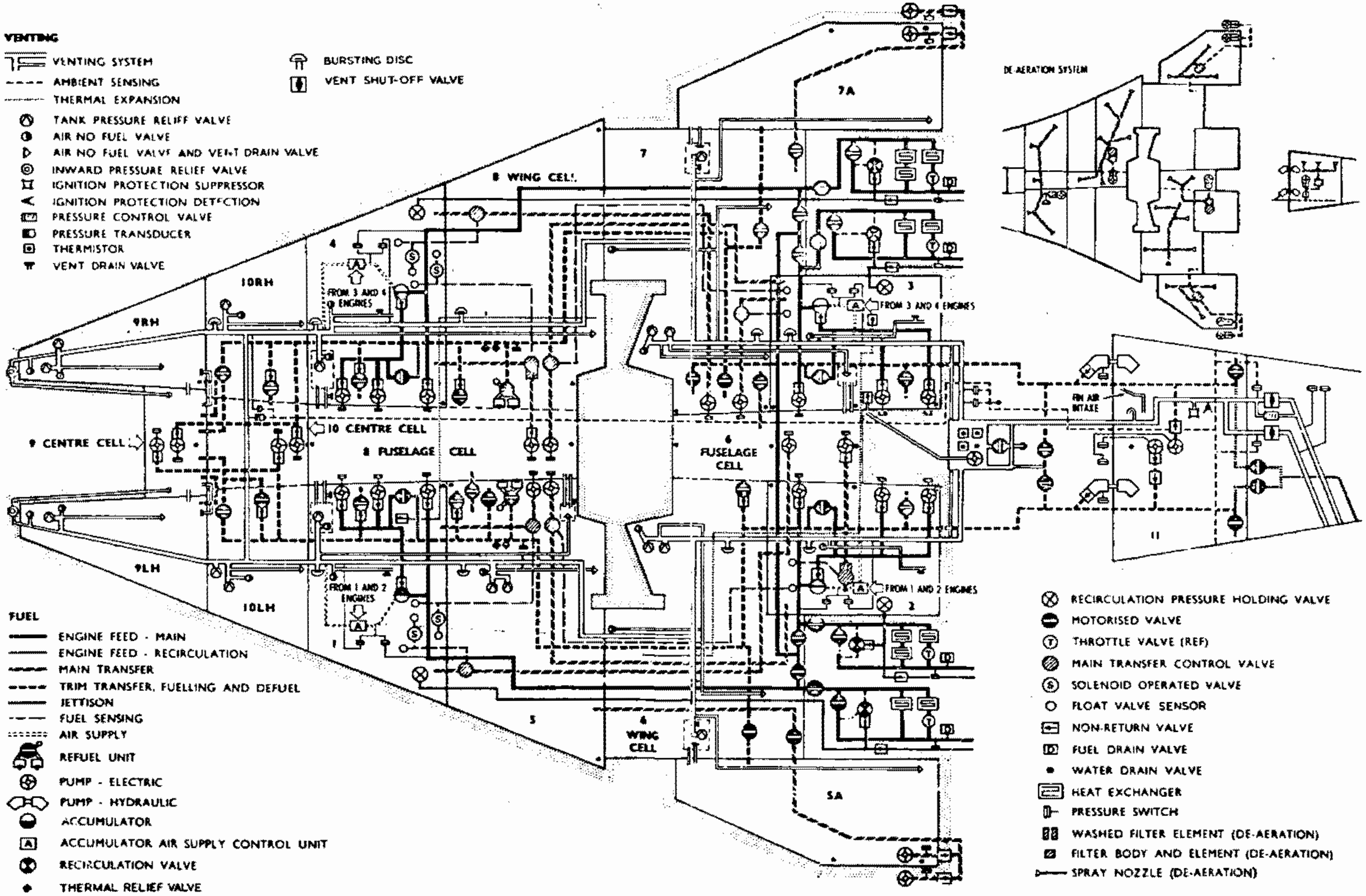

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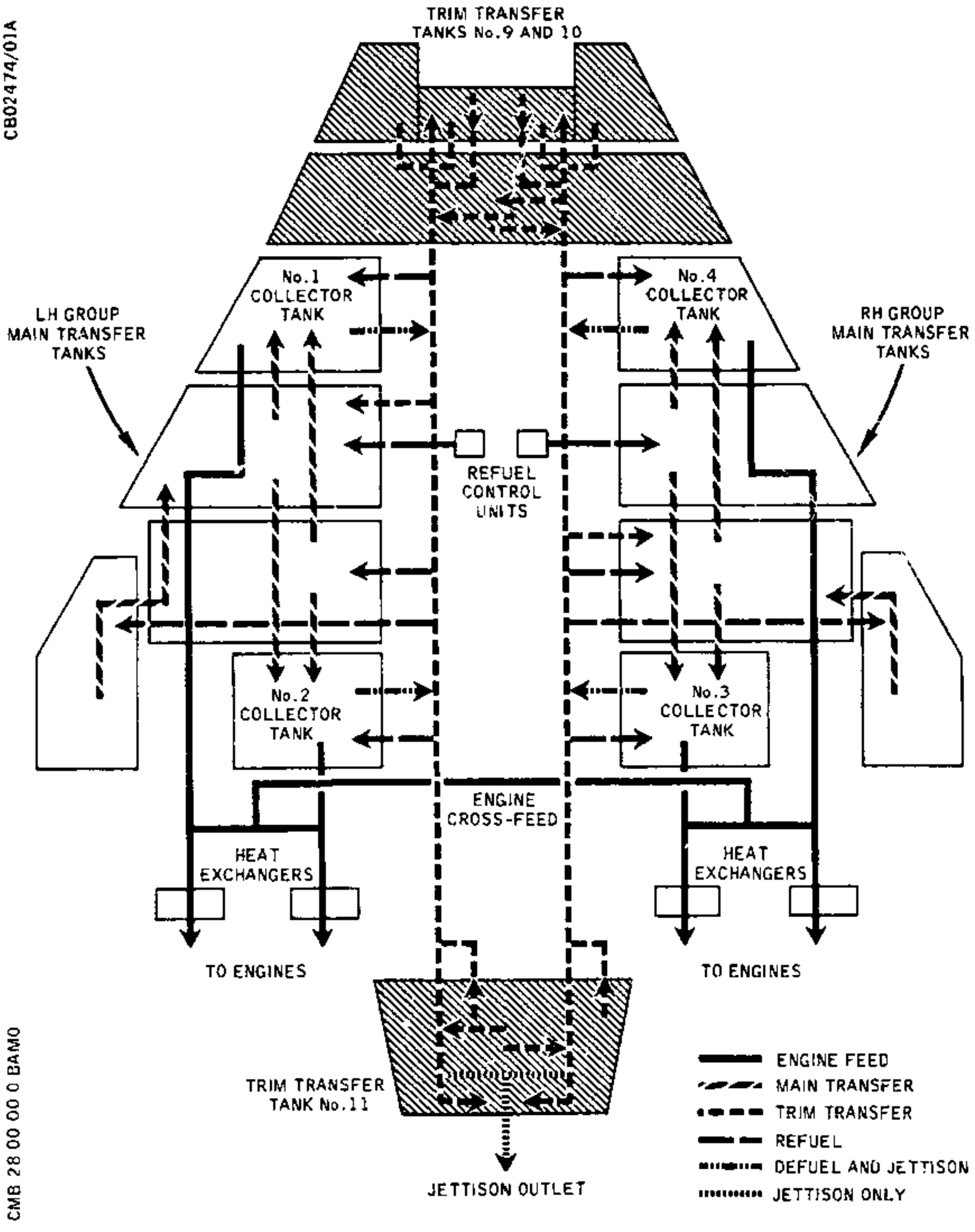
Fuel System Diagram
Figure 001

R



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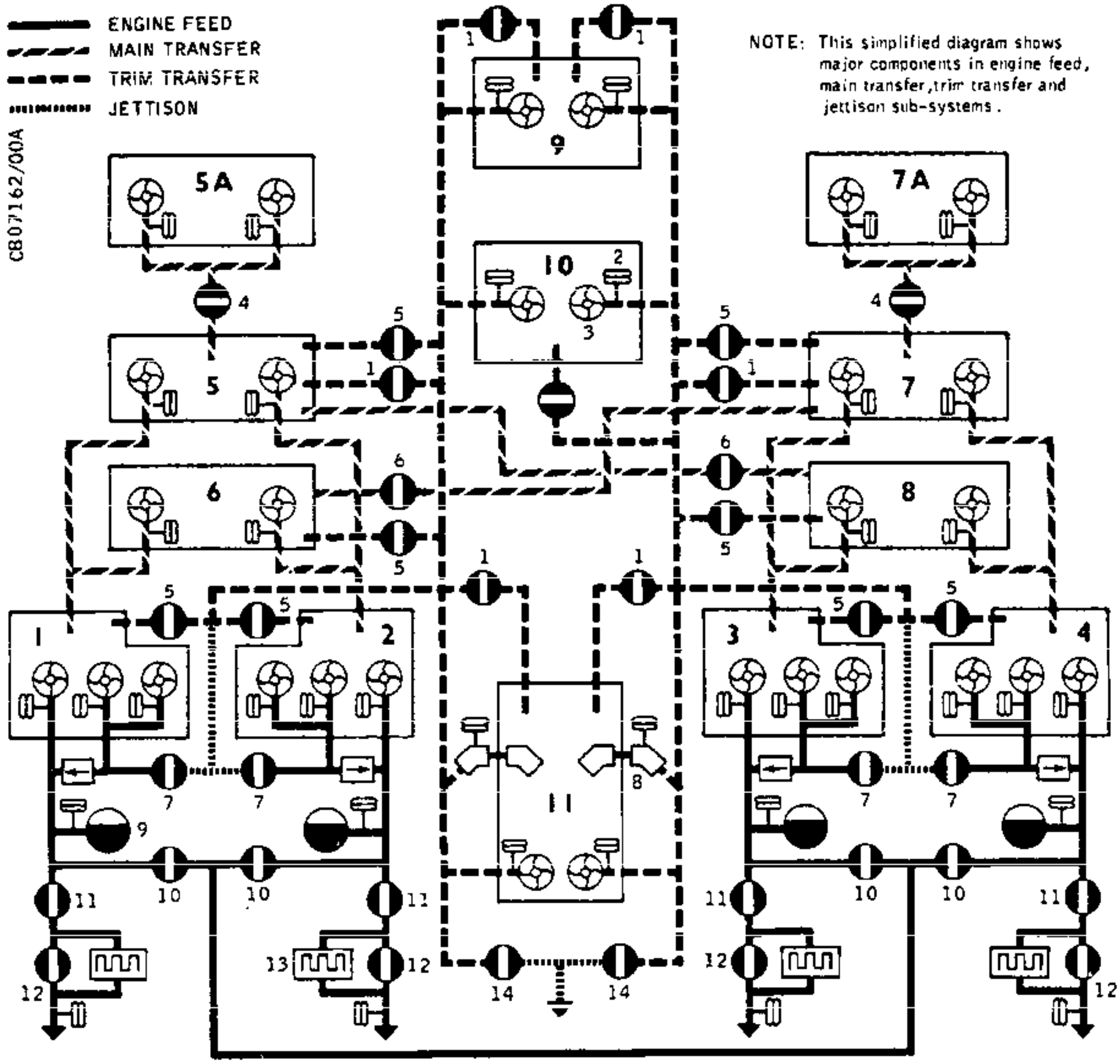
Fuel System - Flow Diagram
Figure 002



1	INLET VALVE	8	FUEL PUMP (HYDRAULIC)
2	PRESSURE SWITCH	9	ACCUMULATOR
3	FUEL PUMP (ELECTRIC)	10	CROSS FEED VALVE
4	TRANSFER SHUT-OFF VALVE	11	LP ISOLATION VALVE
5	STANDBY INLET VALVE	12	BYPASS VALVE
6	INTERCONNECT VALVE	13	HEAT EXCHANGER
7	COLLECTOR TANK JETTISON VALVE	14	MASTER JETTISON VALVE

Fuel System - Simplified Schematic
Figure 003

R

10, a separate de-aeration pump.

11. Power Supplies

The electrical loads of the fuel system are supplied from the electrical power system via circuit breakers on the distribution busbars. The electrical supplies and control are arranged to obviate a total loss of a fuel service resulting from a single electrical failure. The main engine feed pumps are supplied from relight a.c. busbars, the standby engine feed pumps are supplied from essential a.c. busbars and the 2nd standby engine feed pumps are supplied from main a.c. busbars. The main transfer pumps are supplied from main a.c. busbars with the exception of tank 5 to 1 and 7 to 3 pumps; these are supplied from essential a.c. busbars. Trim transfer pumps are supplied from main a.c. busbars, but the control of the hydraulic motor pumps in tank 11 is supplied from essential d.c. busbars.

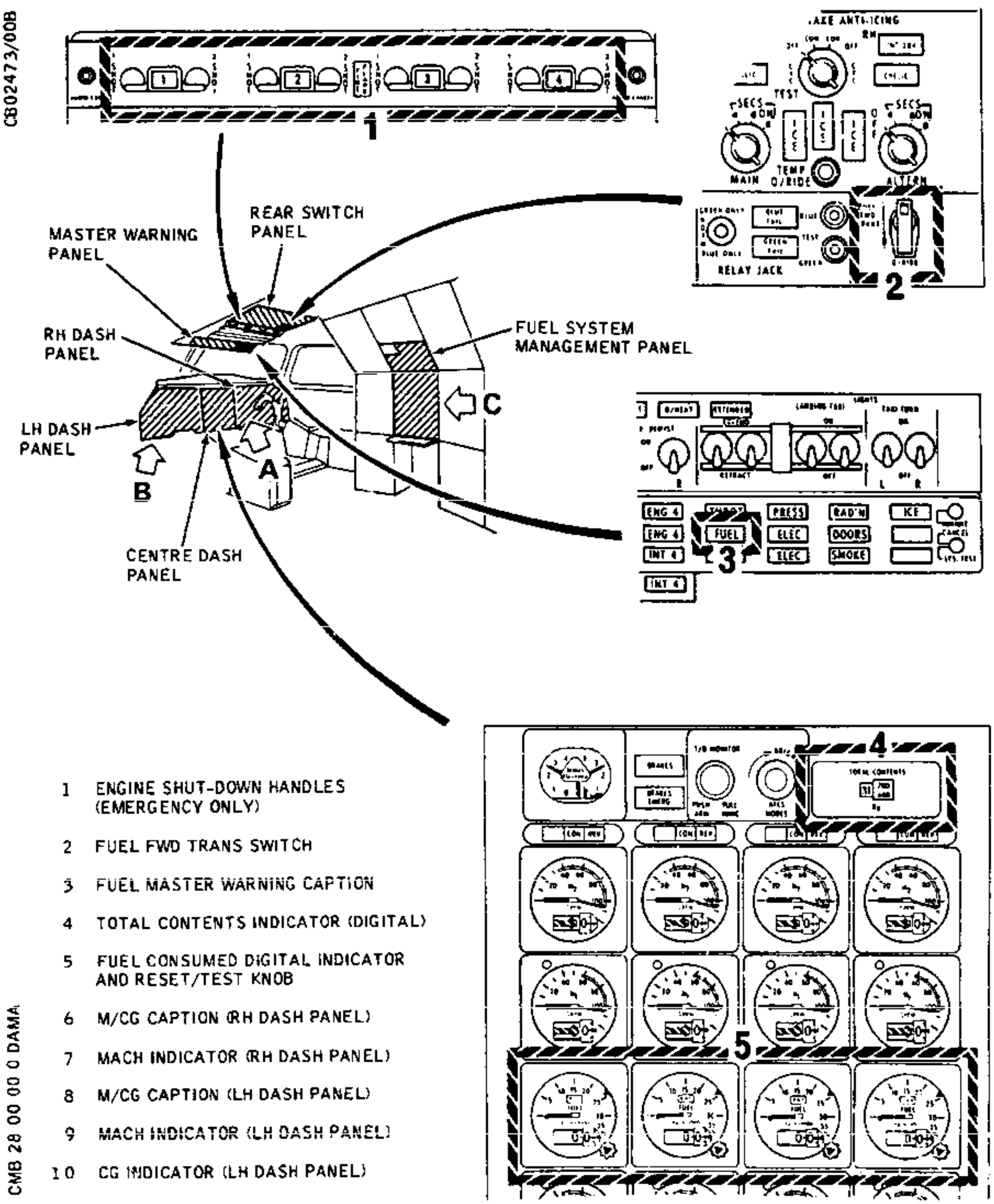
The trim tank inlet valves have twin motors, with motor 1 (main) supplied from main d.c. busbars and motor 2 (override) supplied from essential d.c. busbars. The LP isolation valves have twin motors, one of which is supplied from main d.c. busbars and the other motor from battery busbars. Other valves supplied from essential d.c. busbars are crossfeed, interconnect, overflow relief, vent shut-off, tanks 1 and 3 jettison and both master jettison valves. Main d.c. busbars supply the bypass valves, tanks 2 and 4 jettison valves and all refuel inlet valves.

The main a.c. and d.c. circuit breakers are located above the racking on both sides of the flight compartment. The essential a.c. and d.c. circuit breakers are located forward of the racking on the left-hand side.

12. Indication

A fuel quantity indication system provides indication of individual and total tank contents. The system is also used to provide centre of gravity indication. Signals of fuel quantity are used at pre-selected limits to control trim transfer and partial refuelling.

Level sensors in the fuel tanks provide signals at overfull, high, underfull and low levels. The overfull signals, at approximately 97 per cent tank volume, give indication of an overfull condition and stop refuelling; high level signals, at approximately 95 per cent tank volume, close tank inlet valves when this level is reached during refuelling or fuel transfer; underfull signals, at approximately 80 per cent tank volume, apply to collector tanks, and are used to limit



1 ENGINE SHUT-DOWN HANDLES (EMERGENCY ONLY)

2 FUEL FWD TRANS SWITCH

3 FUEL MASTER WARNING CAPTION

4 TOTAL CONTENTS INDICATOR (DIGITAL)

5 FUEL CONSUMED DIGITAL INDICATOR AND RESET/TEST KNOB

6 M/CG CAPTION (RH DASH PANEL)

7 MACH INDICATOR (RH DASH PANEL)

8 M/CG CAPTION (LH DASH PANEL)

9 MACH INDICATOR (LH DASH PANEL)

10 CG INDICATOR (LH DASH PANEL)

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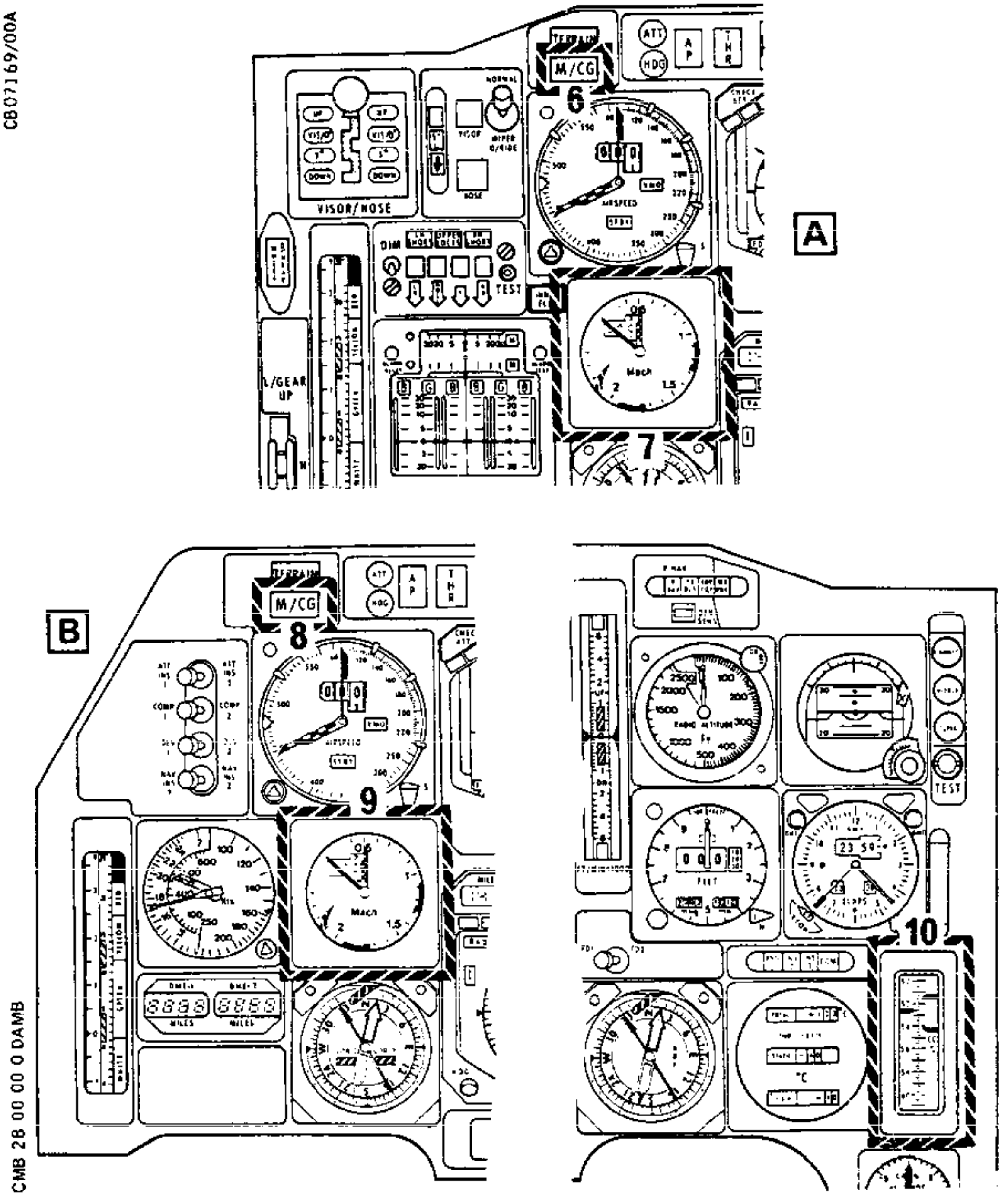
- Controls and Indicators - Flight Compartment
(Sheet 1 of 3)
Figure 004

R



- Controls and Indicators - Flight Compartment
(Sheet 2 of 3)
Figure 004

R

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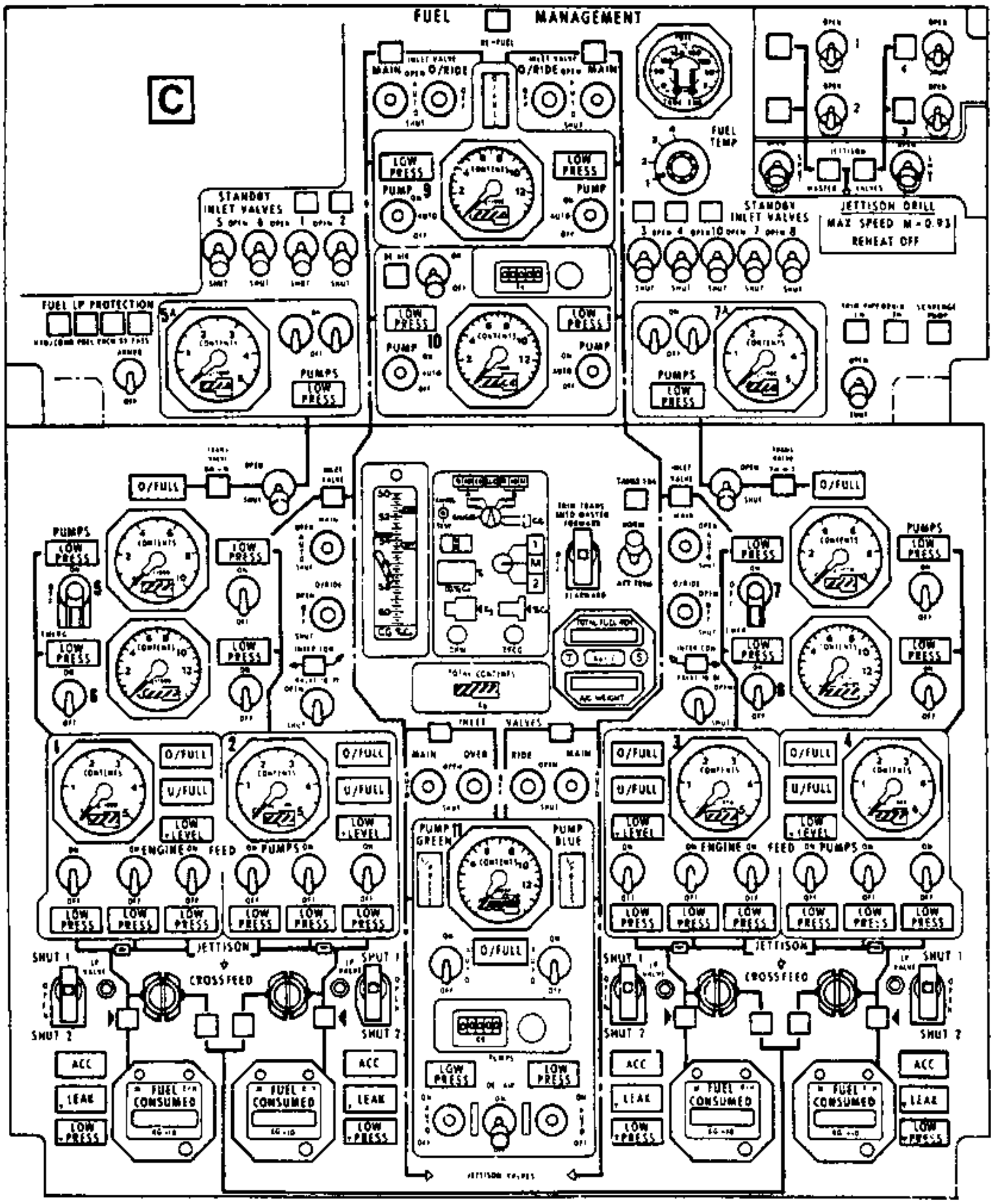

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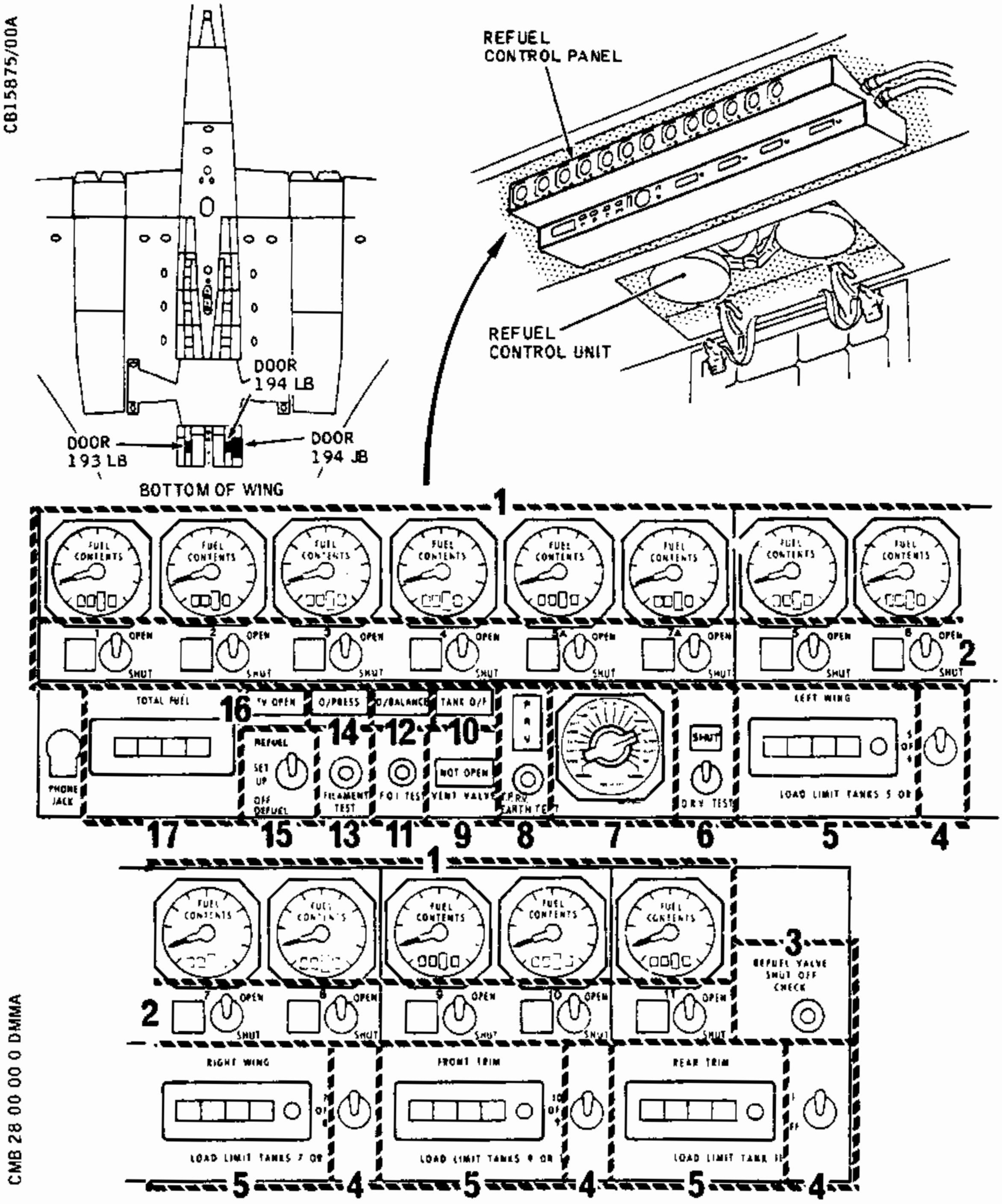
- Controls and Indicators - Flight Compartment
(Sheet 3 of 3)
Figure 004

R



- Controls and Indicators - Refuel Control Panel
(Sheet 1 of 2)
Figure 005

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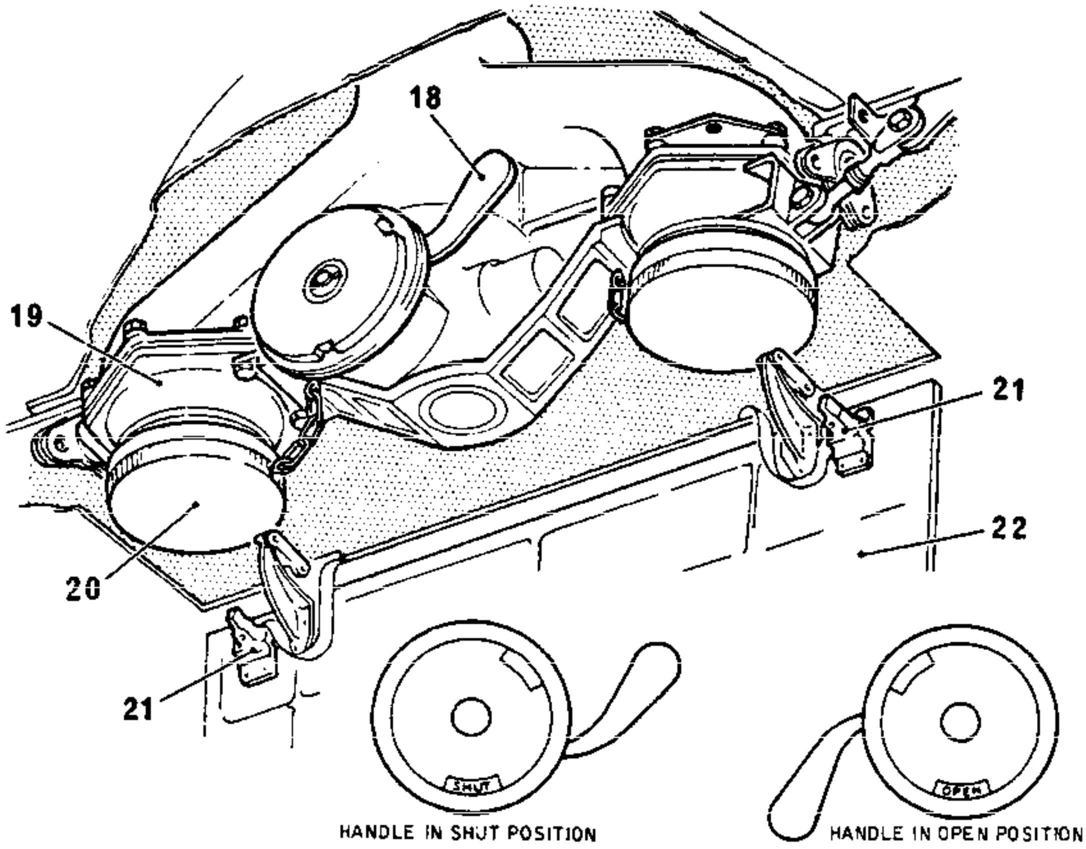

1 FUEL QUANTITY INDICATOR
2 REFUEL VALVE SWITCH
3 REFUEL VALVE SHUT-OFF CHECK SWITCH
4 TANK SELECTOR SWITCH
5 LOAD LIMIT SELECTOR
6 OVERFLOW RELIEF VALVE TEST SWITCH
7 TANK PRESSURE RELIEF VALVE SELECTOR SWITCH
8 T P R V EARTH TEST SWITCH
9 VENT SHUT-OFF VALVE NOT OPEN WARNING CAPTION
10 TANK OVERFULL WARNING CAPTION
11 FUEL QUANTITY INDICATOR TEST SWITCH
12 AIRCRAFT OVERBALANCE WARNING CAPTION
13 FILAMENT TEST SWITCH
14 REFUELLING OVERPRESSURE WARNING CAPTION
15 REFUEL MASTER SWITCH
16 TRIM VALVE OPEN WARNING CAPTION
17 TOTAL FUEL QUANTITY INDICATOR
18 REFUEL CONTROL UNIT HANDLE
19 REFUELLING COUPLING
20 BLANKING CAP
21 BONDING POINT
22 ACCESS DOOR

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AFTER SB 53-042A-
THE RCU DOOR-OPEN LATCH LINK-OVER CENTRE LOCKING SYSTEM IS REPLACED BY A SPRING CLIP LATCH.

Controls and Indicators - Refuel Control Panel
(Sheet 2 of 2)
Figure 005

R

a fuel jettison operation; low level signals, at approximately 20 per cent tank volume, give warning of a dangerously low fuel state in the collector tanks.

13. Controls and Indicators (Ref. Fig. 004)

All controls and indicators normally used in flight are grouped together, in normal sequence of operation, on the fuel system management panel at the third crew member's station. Indication of total fuel quantity and centre of gravity is repeated at the pilot's station. A control on the pilot's roof panel enables the pilot to select forward trim transfer in an emergency. Engine fire controls, to shut-down engines and isolate fuel supplies, are also on the roof panel. Failure warnings within the fuel system are indicated by caption lights on the fuel management panel: in certain instances further warning is given by a master warning caption on the pilot's roof panel. Refuelling controls and indicators are on the refuel control panel, which is in the right-hand wing lower fairing, forward of the main landing gear bays.

14. Flight Compartment Safety Check

R When power is to be applied to the system, this check must be
R carried out when the flight compartment is first entered, to
R ensure the safety of the aircraft and/or personnel.

	FUEL FWD TRANS switch	Guarded
R	TRIM TRANS AUTO MASTER switch	OFF and guarded
	INLET VALVE MAIN, tank 11, switches (2)	AUTO
	INLET VALVE OVERRIDE, tank 11, switches (2)	OFF
	Jettison valves, 1, 2, 3, 4	SHUT
R	JETTISON MASTER VALVES switches (2) ...	OFF
R	Jettison panel transparent covers ...	Closed
	STANDBY INLET VALVES switches (9) ...	SHUT
	TRIM PIPE DRAIN switch	SHUT

15. Flight Compartment Preparation Check

R The flight compartment preparation check lists all the oper-
R ations to be performed on the controls and indicators in the
R flight compartment, during refuelling, in order to prepare the
R fuel system for operation.

R	Electrical ground power	On (Ref. 24-41-00, Servicing)
R	'M' caption (white)	Off
R	U/FULL captions (4) (yellow)	On or off
R	LOW LEVEL captions (4) (amber) ...	On or Off
R	LOW PRESS captions, engine feed, (12) (yellow)	On
R	ACC captions (4) (yellow)	On
R	LOW PRESS captions, engine inlet (4) (amber)	On or off
	All other captions	Off
R	REFUEL magnetic indicator (MI) ...	GRD
R	T/O CG switch	NORM
R	Fuel quantity indicators (tanks 1 to 8)	Failure flags
R	Fuel quantity indicators (digital) (tanks 9, 10, 11)	Black bars
	INLET VALVE MAIN, tank 9, switches (2)	AUTO
	INLET VALVE OVERRIDE, tank 9, switches (2)	OFF
R	INLET VALVE, tank 9, MIs (2)	Cross-line
R	PUMP, tanks 9 and 10, switches (4) ...	ON
R	LOW PRESS captions, tanks 9 and 10 (4)	On, then off
R	PUMP, tanks 9 and 10, switches (4) ...	OFF
	DE-AIR switch, tank 10	OFF
R	DE-AIR MI, tank 10	OFF

R	Fuel quantity indicator (FQI) test	
R	multi-position rotary (MPR) switch ...	OFF
	CG% Co indicator	No failure flag visible
R	CG limit bug FWD	51.8 % approx.
R	CG limit bug AFT	53.8 % approx.
R	CG channel rotary selector	M
	TANKS 1 & 4 switch	NORM
	TANKS 1 & 4 MI	NORM
	TOTAL CONTENTS indicator	No failure flags visible
R	TOTAL FUEL REM and	
R	A/C WEIGHT, rotary selector	N
R	TOTAL FUEL REM knob T	Press and hold
R	TOTAL FUEL REM digital indicator ...	'8's
R	A/C WEIGHT digital indicator	'8's
R	TOTAL FUEL REM knob T	Release, digital indicators return to previous values
	INLET VALVE MAIN, tank 11, switches (2)	AUTO
	INLET VALVE OVERRIDE, tank 11,	
	switches (2)	OFF
R	INLET VALVE MI, tank 11, RH	Cross-line
R	INLET VALVE MI, tank 11, LH	In accord with refuelling
	PUMP GREEN, tank 11, switch	AUTO
	PUMP BLUE, tank 11, switch	AUTO
	PUMPS, tank 11, left and right,	
R	switches	ON
R	LOW PRESS captions, tank 11 (2) (yellow)	On, then off
R	PUMPS, tank 11, left and	
R	right switches	AUTO
	DE-AIR, tank 11, switch	OFF
R	Jettison valves, 1, 2, 3, 4 MIs ...	Cross-line
R	JETTISON MASTER VALVE MIs (2)	Cross-line
	FUEL TEMP, rotary selector	2, 3, 4, 1, in turn
R	TANK and ENG, temp. indicators... ...	Sensible readings
	STANDBY INLET VALVES switches (9) ...	SHUT
R	STANDBY INLET VALVES MIs (5)	In accord with refuelling
R	FUEL LP PROTECTION switch	ARMED
R	HYD/COND FUEL EXCH BY-PASS MIs (4) ...	OPEN or black
R	PUMPS, tank 5A, switches (2)	
R	(individually)	ON, then OFF
R	LOW PRESS caption, tank 5A (yellow) ...	On, then off
R	PUMPS, tank 7A, switches (2)	
R	(individually)	ON, then OFF
R	LOW PRESS caption, tank 7A (yellow) ...	On, then off

R	TRIM PIPE DRAIN switch	OPEN, then SHUT
R	TRIM PIPE DRAIN MIs (LH and RH)	OPEN, then SHUT
R	SCAVENGE PUMP MI	ON or OFF
R	TRANS VALVE 5A-5 switch	SHUT
R	TRANS VALVE 5A-5 MI	Cross-line
R	TRANS VALVE 7A-7 switch	SHUT
R	TRANS VALVE 7A-7 MI	Cross-line
R	PUMPS, tank 5, left switch	ON
R	LOW PRESS caption, tank 5 left (yellow)	On, then off
R	PUMPS, tank 5, left switch	OFF and guarded
R	PUMPS, tank 5, right switch	ON
R	LOW PRESS caption, tank 5, right (yellow)	On, then off
R	PUMPS, tank 5, right switch	OFF
R	PUMPS, tank 7, left switch	ON
R R	LOW PRESS caption, tank 7, left (yellow)	On, then off
R	PUMPS, tank 7, left switch	Off and guarded
R	PUMPS, tank 7, right switch	ON
R R	LOW PRESS caption, tank 7, right (yellow)	On, then off
R	PUMPS, tank 7, right switch	OFF
	INLET VALVE MAIN, tank 5, switch	AUTO
	INLET VALVE OVERRIDE, tank 5, switch	OFF
R	INLET VALVE, tank 5, MI	Cross-line
	INLET VALVE MAIN, tank 7, switch	AUTO
	INLET VALVE OVERRIDE, tank 7, switch	OFF
R	INLET VALVE, tank 7, MI	Cross-line
R	PUMPS, tank 6, switches (2)	ON, then OFF
R	LOW PRESS captions, tank 6, (2) (yellow)	On, then off
R	PUMPS, tank 8, switches (2)	ON, then off
R	LOW PRESS captions, tank 8, (2) (yellow)	On, then off
	INTER-CON VALVE (6-7) switch	SHUT
R	INTER-CON VALVE (6-7) MI	SHUT
	INTER-CON VALVE (5-8) switch	SHUT
R	INTER-CON VALVE (5-8) MI	SHUT
R	LOW LEVEL captions, (4) (amber)	Press
R R R	LOW LEVEL captions, (4) (amber)	On, at MW FUEL (amber) on, and audio (gong)
R	ENGINE FEED PUMPS, switches (12)	ON, then OFF
R R	LOW PRESS captions, engine feed (12) (yellow)	Off, then on
R	LP VALVE, engine 1, switch	OPEN and guarded
R	LP VALVE, engine 1, MI	In-line
R	LP VALVE, engine 1, pea light	OFF
R	LP VALVE, engine 2, switch	OPEN and guarded
R	LP VALVE, engine 2, MI	In-line
R	LP VALVE, engine 2, pea light	OFF
R	LP VALVE, engine 3, switch	OPEN and guarded

R	LP VALVE, engine 3, MI	... ...	In-line
R	LP VALVE, engine 3, pea light	... ...	OFF
R	LP VALVE, engine 4, switch	... ...	OPEN and guarded
R	LP VALVE, engine 4, MI	... ...	In-line
R	LP VALVE, engine 4, pea light	... ...	OFF
R R	CROSSFEED, engine 1, rotary selector	...	In-line, then cross-line
R R	CROSSFEED, engine 1, MI	... ...	In-line, then cross-line
R R	CROSSFEED, engine 2, rotary selector	...	In-line, then cross-line
R R	CROSSFEED, engine 2, MI	... ...	In-line, then cross-line
R R	CROSSFEED, engine 3, rotary selector		In-line, then cross-line
R R	CROSSFEED, engine 3, MI	... ...	In-line, then cross-line
R R	CROSSFEED, engine 4, rotary selector		In-line, then cross-line
R R	CROSSFEED, engine 4, MI	... ...	In-line, then cross-line
R	LEAK captions, (4) (red)	... ...	Press
R R R	LEAK captions, (4) (red)	... ...	On, at MW ENG (red) on, and audio (gong)
R R	LOW PRESS captions, engine inlet, (4) (amber)	... ...	Press
R R R	LOW PRESS captions, (4) (amber)	...	on, at MW FUEL (amber) on, and audio (gong)
	FUEL CONSUMED reset/test knob, engine 1	... ...	Pull, turn, release
R	FUEL CONSUMED digital indicator, engine 1	... ...	0 - least sig. figure; other spaces blank
	FUEL CONSUMED reset/test knob, engine 2	... ...	Pull, turn, release
R	FUEL CONSUMED digital indicator, engine 2	... ...	0 - least sig. figure; other spaces blank
	FUEL CONSUMED reset/test knob, engine 3	... ...	Pull, turn, release
R	FUEL CONSUMED digital indicator, engine 3	... ...	0 - least sig. figure; other spaces blank

	FUEL CONSUMED reset/test knob, engine 4	Pull, turn, release
R	FUEL CONSUMED digital indicator, engine 4	0 - least sig. figure; other spaces blank
	TANK PRESSURE gauge	No failure flag visible

16. Refuelling/Walk Round Check

R These checks are carried out at the fuel management panel
R after refuelling is completed and confirm that the fuel
R system is operational.

R	REFUEL MI	FLT
R R	STANDBY INLET VALVES MIs, tanks 1, 2, 3, 4 and 10	SHUT
	SCAVENGE PUMP MI	Not ON permanently
R	MASTER JETTISON VALVES, switches (2)...	OFF
R	MASTER JETTISON VALVES, MIs	Cross-line
R R	JETTISON VALVES, switches (4)	OPEN, then shut
R R	JETTISON VALVES, MIs	In-line, then cross-line

R Fuel Quantity Indication (FQI) Check:

R	Multi-position rotary (MPR) switch	GAUGES
R	FQI TEST - CANCEL switch	TEST, and hold
R	Indicator, tank 11	Increases by 3,000 kg
R R	Indicators, tanks 9 and 10	Increase by 500(±150) kg each
R R	Indicators, tanks 5, 6, 7 and 8 ...	Increase by 500(±100) kg each
R R	Indicators, tanks 5A, 7A, 1, 2, 3 and 4	Increase by 200(±50) kg each
R	TOTAL CONTENTS indicator	Increases by approx. 7,200 kg
R R	CG% Co indicators (2)	1 % approx. aft movement
R	CG digital display	1 % approx.

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R		aft
R	MACH indicator bugs, panels 2-211, 2-212	Reposition AFT on scale, FWD on higher Mach No.
R	M/CG caption (2) (red), panels ... 2-211, 2-212	ON
R	CG% Co indicator pea lights (red) ...	ON
R	M/CG master warning caption (red) ...	ON
R	Master warning - audio (Ref. 33-15-00)	Gong
	FQI test switch	Released
	FQI and CG indicators	Return to pre-test readings
	All warning lights	Extinguished
	Master warning - audio...	Cancelled
R	MPR switch	MIN A
	FQI test switch	TEST, and hold
R	Indicator lights, channel A, 9, 10, 11 (yellow)	On within 6(±1) s
	FQ1 test switch	CANCEL, and release
R	Indicator lights 9, 10, 11 (yellow)	Off
R	MPR switch	MAX.A
	FQI test switch	TEST, and hold
R	Indicator lights, channel A, 9, 10, 11 (yellow)	On within 1.5(±0.5) s
	FQ1 test switch	CANCEL, and release
R	Indicator lights 9, 10, 11 (yellow)	Off
R	MPR switch	MAX.B
	FQI test switch	TEST, and hold
R	Indicator lights, channel B, 9, 10,	
R	11 (yellow)	On within 1.5(±0.5) s
	FQ1 test switch	CANCEL, and release
R	Indicator lights 9, 10, 11 (yellow)	Off
	MPR switch	MIN B
	FQI test switch	TEST, and hold
R	Indicator lights, channel B, 9, 10,	
R	11 (yellow)	On within 6(±1) s
	FQ1 test switch	CANCEL,

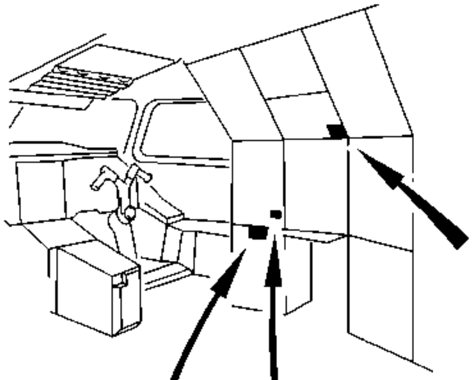
		and release
R	Indicator lights 9, 10, 11 (yellow)	Off
R	CG channel selector switch	M
R	MPR switch	1 CG
	FQI test selector	TEST, and hold
R	Comparator lights (5) (yellow) ...	Off
R	Channel A 11 light (yellow)	On
	FQI test selector	Release
R	Channel A 11 light (yellow)	Off
R	MPR switch	2 CG
	FQI test selector	TEST, and hold
R	Comparator lights (5) (yellow) ...	Off
R	Channel B 11 light (yellow)	On
	FQI test selector	Release
R	Channel B 11 light (yellow)	Off
R	MPR switch	FIL
	FQI test switch	TEST, and hold
	CG display	88.8
	FQI test switch	Release
R	MPR switch	Off
R	INLET VALVES, tank 11 LH, MI ...	Cross-line
	FQI tanks 1 to 8	No failure flags
	FQI tanks 9 to 11 digital indicators	Not obscured
R	All tank contents indicators and TOTAL CONTENTS indicator	Agree with fuelling load

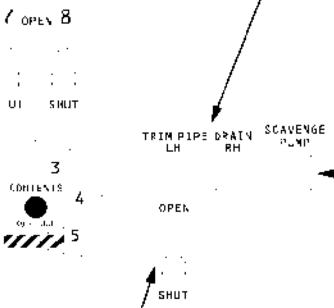
17. Sub-system Management (Ref. Fig. 006, 007 and 008)
(Ref. Fig. 009, 010 and 011)
R (Ref. Fig. 012, 013 and 014)

R CAUTION: OBSERVE THE 'AIRCRAFT GROUND STABILITY'
R PROCEDURES DETAILED IN 12-00-10.

Management procedures for the fuel sub-systems, which enable the systems to be operated and monitored either to prove the system and its components or for servicing purposes, are carried out by means of switches, indicators and gauges on the fuel management panel.

To carry out these procedures, electrical ground power must be connected to the aircraft and the tanks must contain fuel, although it is essential to ensure that there is sufficient room in the receiving tanks for any fuel which may be transferred during the operation of the sub-systems.





TRIM PIPE DRAIN VALVE MIs (LH and RH)

OPEN | /// | SHUT

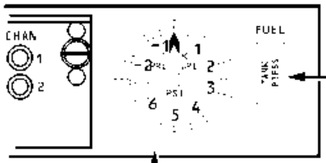
SCAVENGE PUMP MI

ON | OFF

Indicates the pump is running. The scavenge pump removes any fuel that has entered the scavenge tank from the main tanks, through the vent system, and returns it to tank 3. Operation of the pump is automatic.

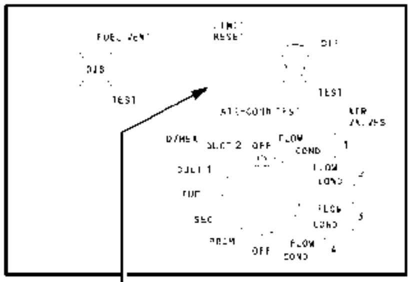
TRIM PIPE DRAIN VALVE SWITCH

Set to OPEN - opens both LH and RH trim pipe drain valves to connect the main trim transfer pipes to the vent scavenge tank.



TANK PRESS LIGHT (Amber)

Illuminated - indicates one of three conditions:
The fuel vent gallery to atmosphere differential pressure is high and rising, or low and falling, or the vent gallery absolute pressure is below 2 psi at altitude.
Accompanied by the master warning FUEL light (amber) and audio warning (gong).



TANK PRESSURE GAUGE

Shows the pressure differential between the pressure in the right-hand vent gallery and static pressure.
A red and black flag in a window on the left-hand side of the gauge indicates a power loss or indication failure.
Two red secondary pointers remain at the maximum and minimum pressure difference attained during operation.
The secondary pointers are reset by using the LIMIT RESET push-button.

LIMIT RESET BUTTON

Pressed - resets the N1 and N2 overlimit pointers; also resets the Fuel Tank Pressure gauge secondary pointers.

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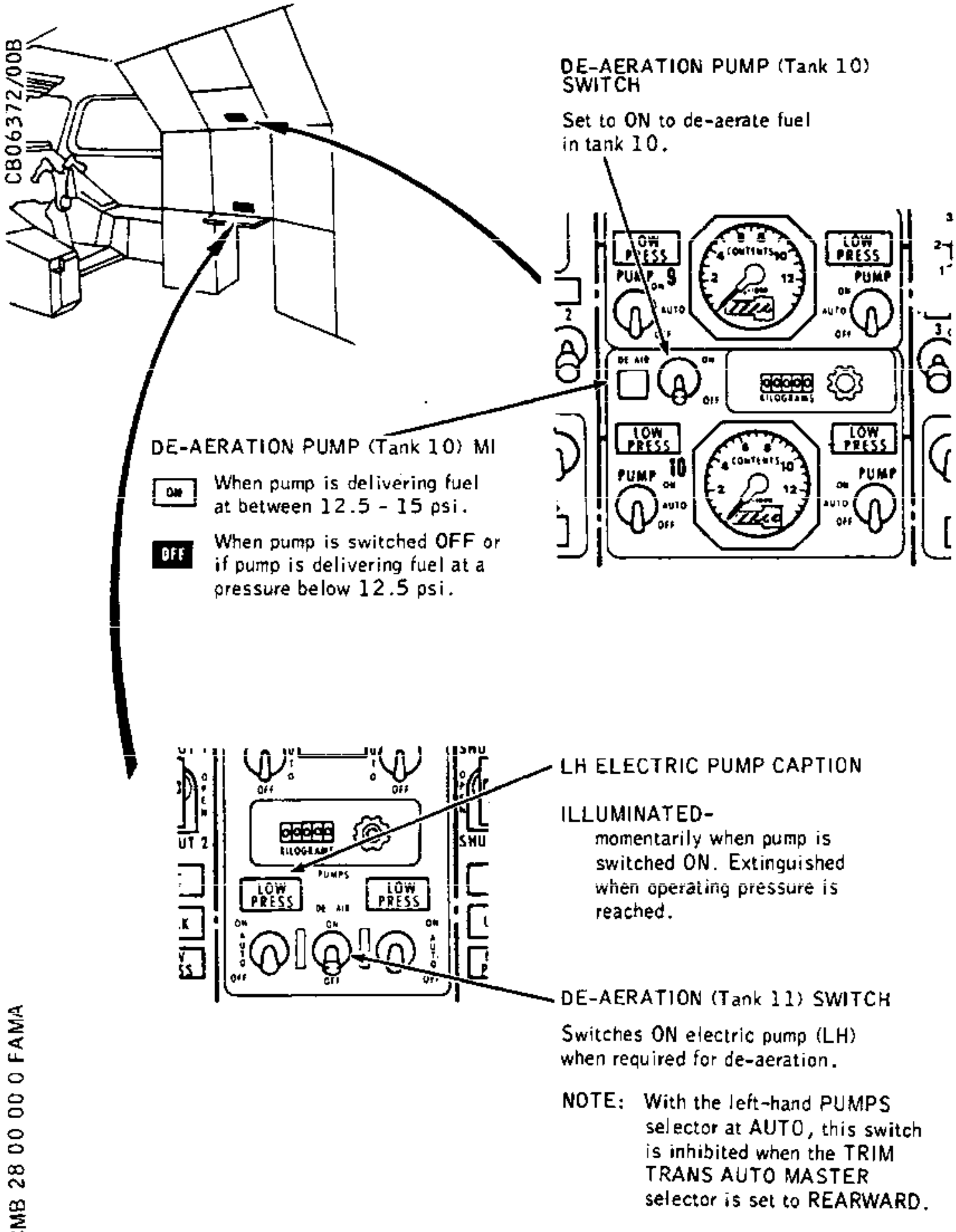
Sub-system Management (Vent)
Figure 006

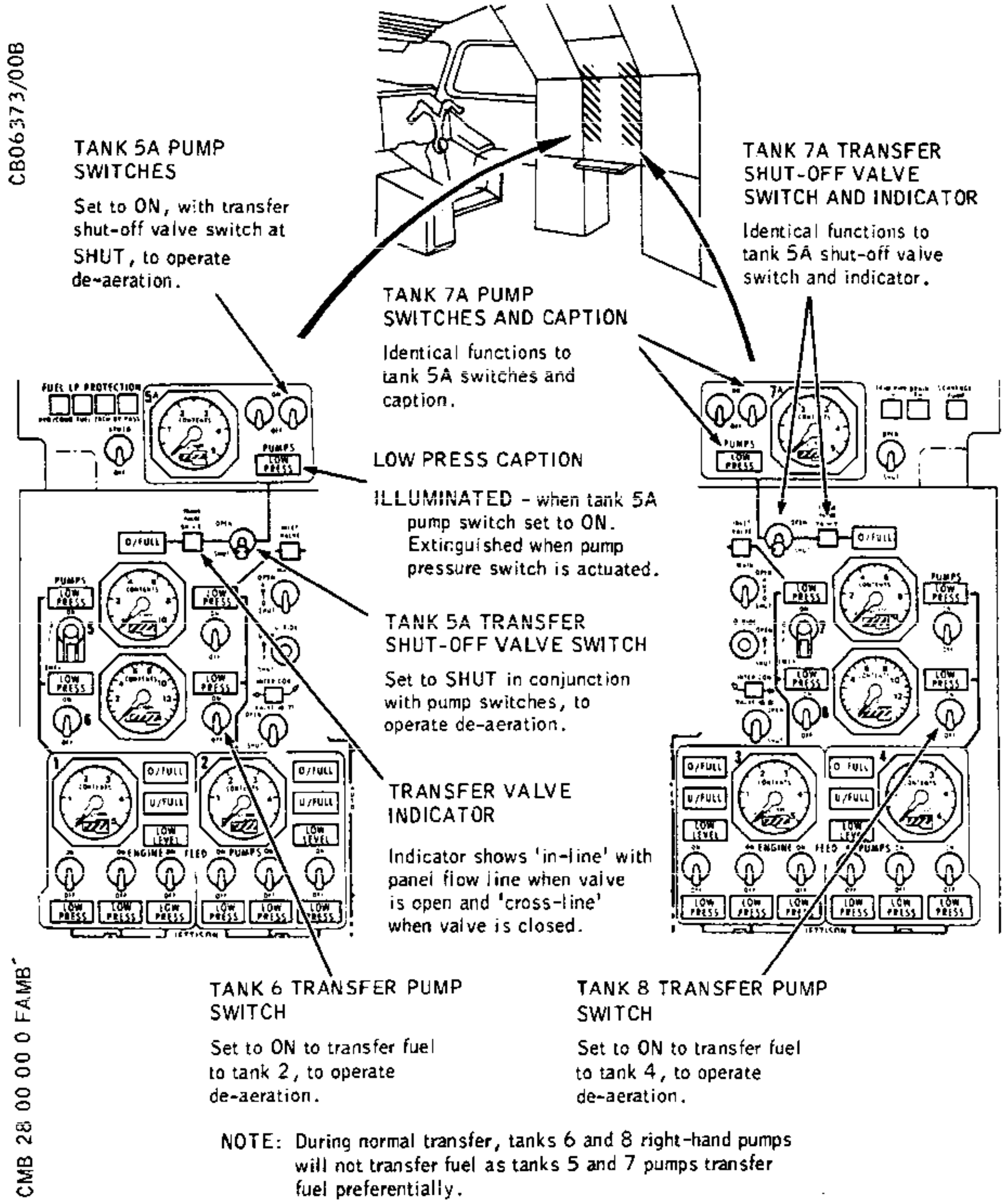
R



CMB 28 00 00 0 FAMA

Sub-system Management (De-aeration)
(Sheet 1 of 2)
Figure 007

R

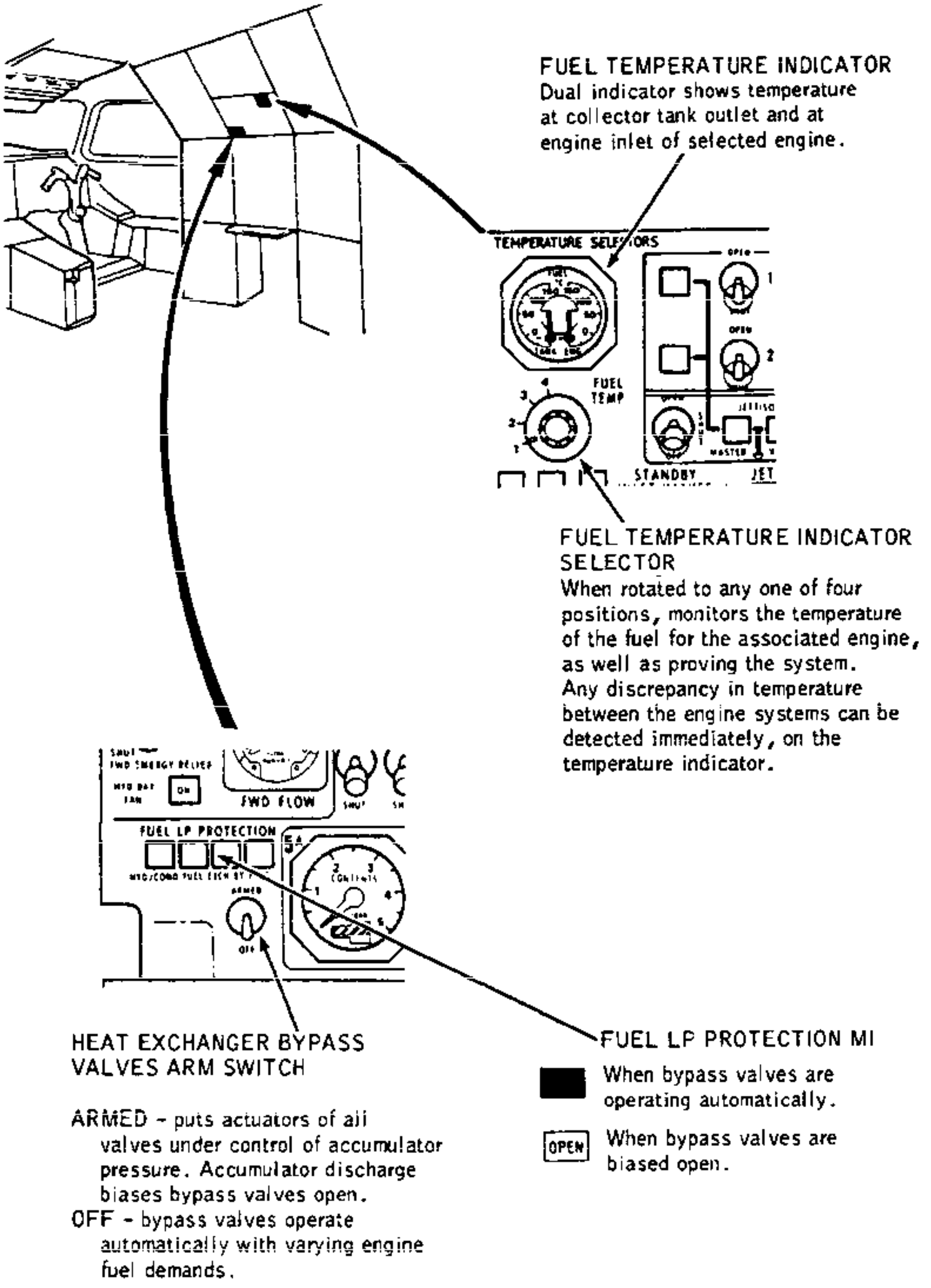


NOTE: During normal transfer, tanks 6 and 8 right-hand pumps will not transfer fuel as tanks 5 and 7 pumps transfer fuel preferentially.

Sub-system Management (De-aeration)
(Sheet 2 of 2)
Figure 007

R

CB06374/00B

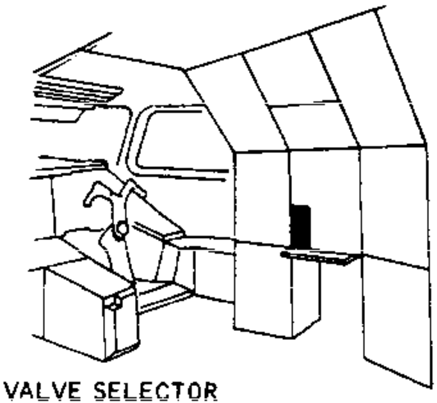


CMB 28 00 00 0 GAMA

\- Sub-system Management (Engine Feed)
(Sheet 1 of 2)
Figure 008

R

CB06375/00B



ENGINE FEED PUMPS SWITCH

MAIN

STANDBY 1

STANDBY 2

PUMP LOW PRESS CAPTION (Yellow)

ILLUMINATED - indicates a low pressure condition exists at the pump outlet.

LP VALVE SELECTOR

OPEN - the LP valve is open except when the engine shut-down handle is pulled, in which case it is shut. Alternative SHUT positions permit selection of either motor.

SHUT 1 and SHUT 2 - the LP valve is shut, using the associated motor.

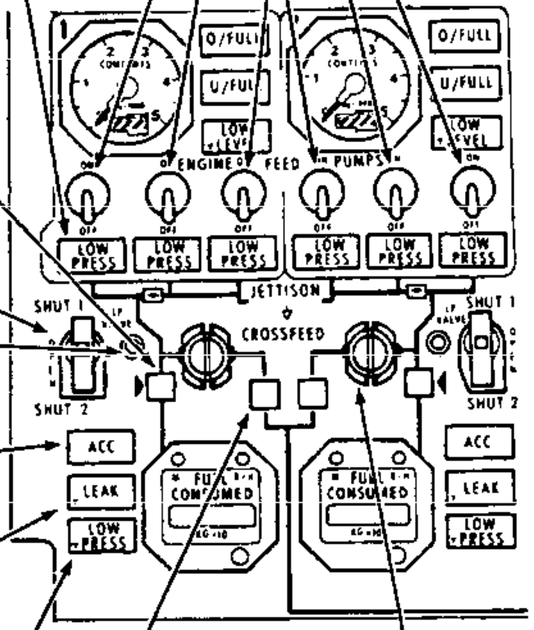
LP VALVE MI

LP VALVE PEA LIGHT (White)

If illuminated when switch is at SHUT 2, a valve control relay failure is indicated.

ACC CAPTION (Yellow)

ILLUMINATED - indicates either a low-level fuel pressure downstream of the collector tank pumps or a low air pressure in the accumulator.



LEAK CAPTION (Red)

ILLUMINATED - indicates a fluid leak in the dry bay area above the engine. Accompanied by a master warning system ENG light (red) and audio warning (gong) and engine shut-down handle light (red).

CROSSFEED MI

CROSS-FEED ROTARY SELECTOR

When set to in-line, the particular engine feed system is interconnected to any engine feed system that has its cross feed selector set to in-line.

ENGINE INLET LOW PRESS CAPTION (Amber)

ILLUMINATED - indicates that a low pressure condition exists upstream of the engine pump. Accompanied by a master warning system FUEL light (amber) and audio warning (gong).

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\- Sub-system Management (Engine Feed)
(Sheet 2 of 2)
Figure 008

R

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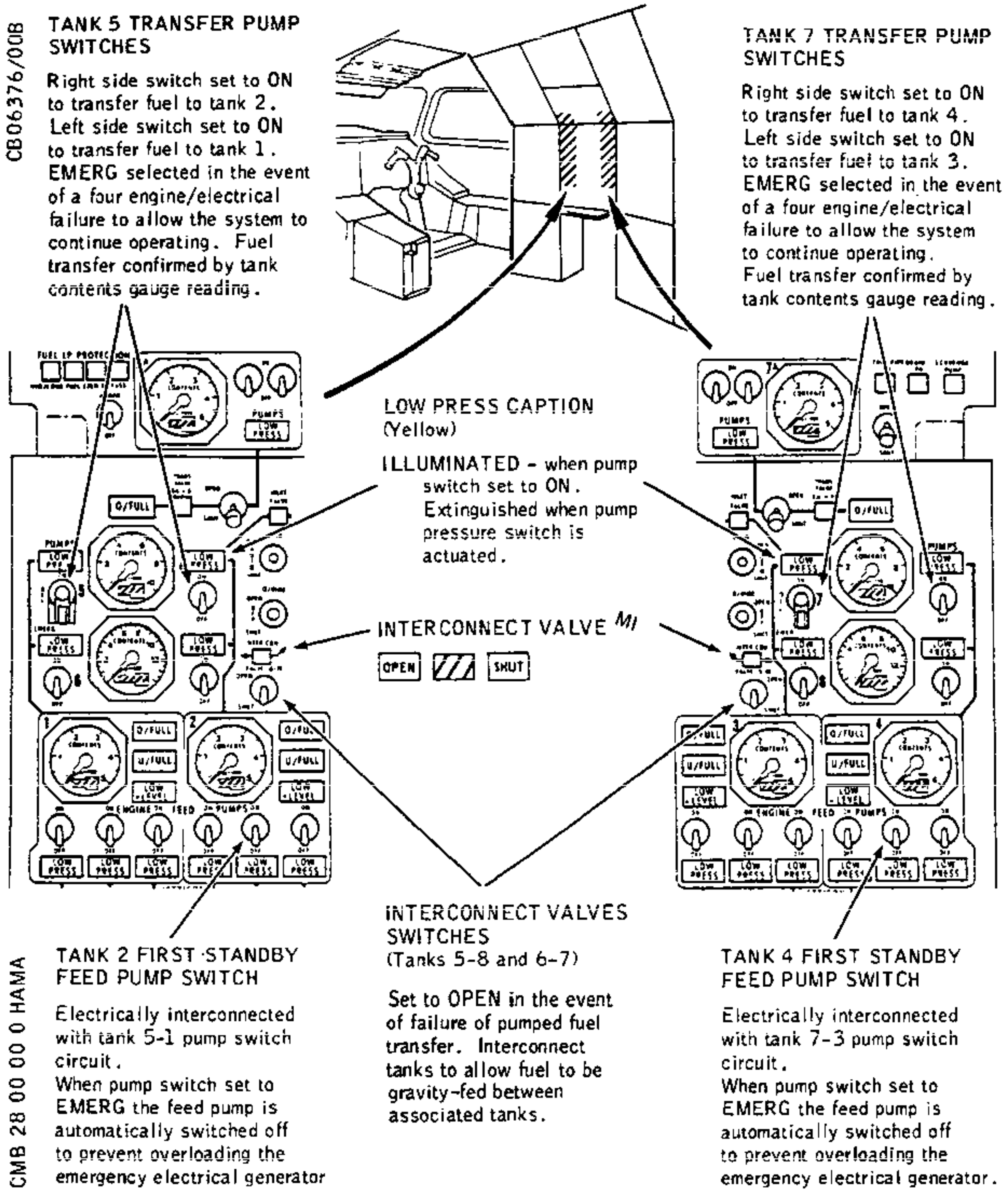
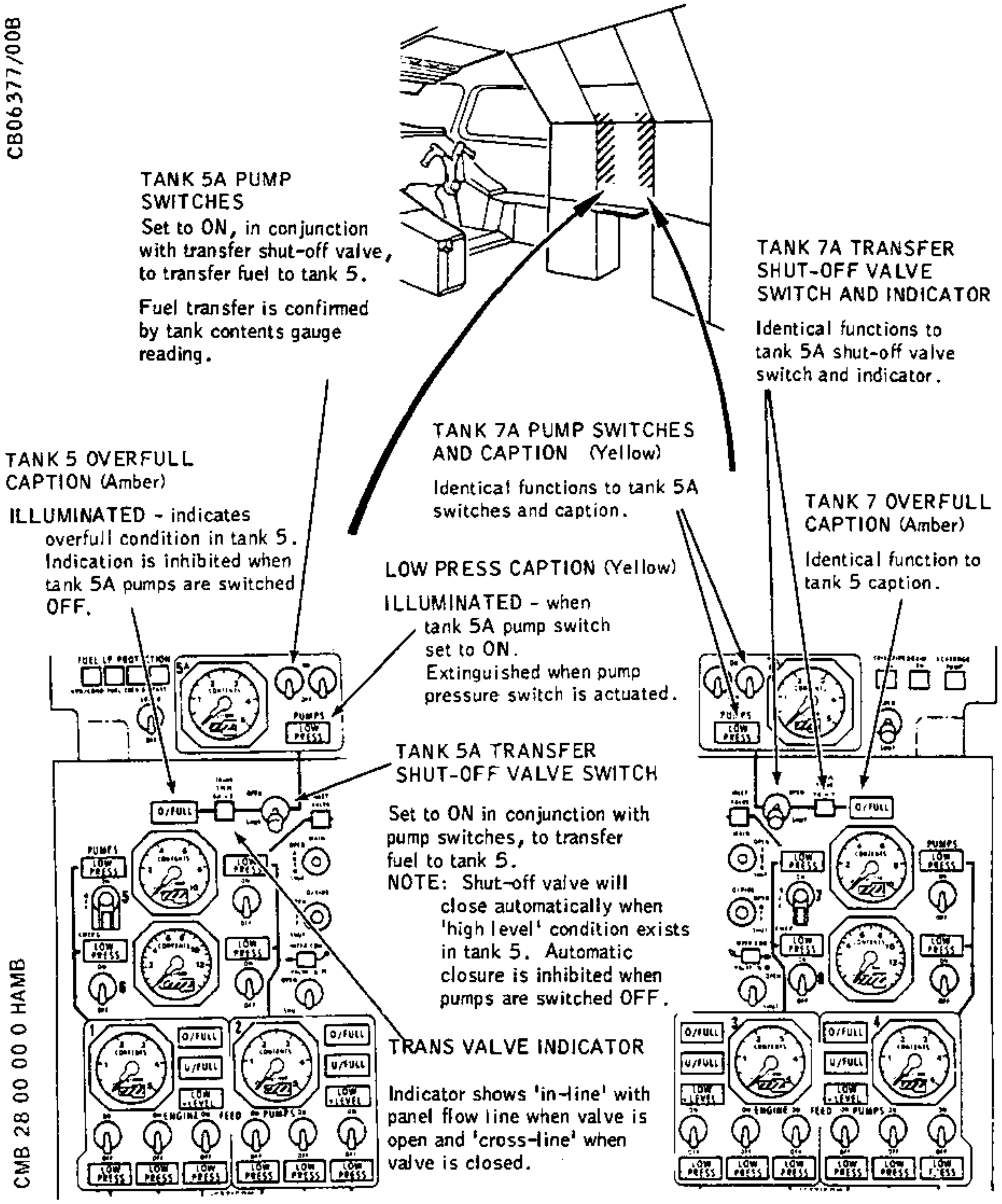


- Sub-system Management (Main Transfer)
(Sheet 1 of 3)

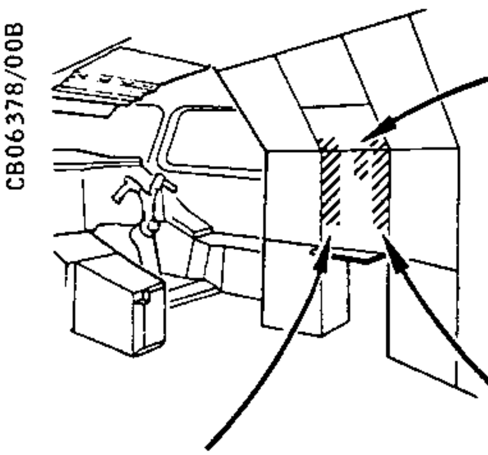
R Figure 009

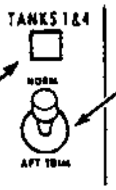


\- Sub-system Management (Main Transfer)
(Sheet 2 of 3)
Figure 009

R

CB06378/00B



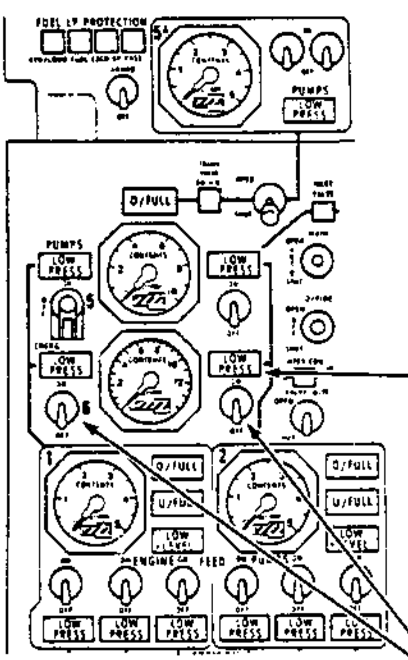


TANK 1 & 4 TRIM SWITCH

Set to AFT TRIM to close solenoid operated shut-off valves in the 'high level' sense lines of the transfer control valves of tanks 1 and 4.
Reduced fuel level sensors in these tanks then control the appropriate fuel level.

TRIM MI

NORM - switch at NORM.
AFT - switch at AFT TRIM. Diagonal stripes indicate electrical failure.

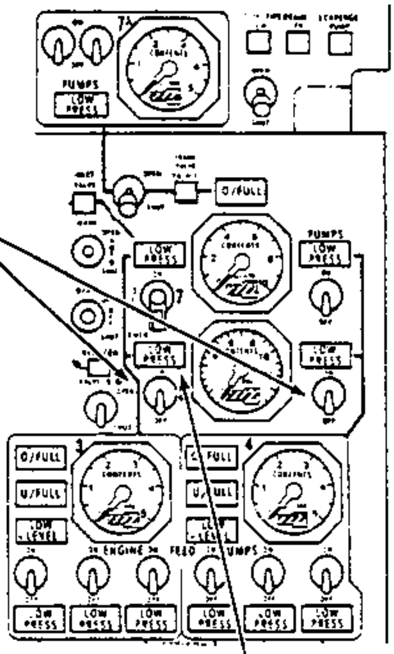


TANK 8 TRANSFER PUMP SWITCHES

Left side switch set to ON to transfer fuel to tank 3. Right side switch set to ON to transfer fuel to tank 4. Fuel transfer is controlled by sensor-operated control valves and confirmed by tank contents gauge reading.

LOW PRESS CAPTION (Yellow)

ILLUMINATED - when tank 6 pump switch set to ON. Extinguished when pump pressure switch is actuated.



TANK 6 TRANSFER PUMP SWITCHES

Left side switch set to ON to transfer fuel to tank 1. Right side switch set to ON to transfer fuel to tank 2. Fuel transfer confirmed by tank contents gauge reading.

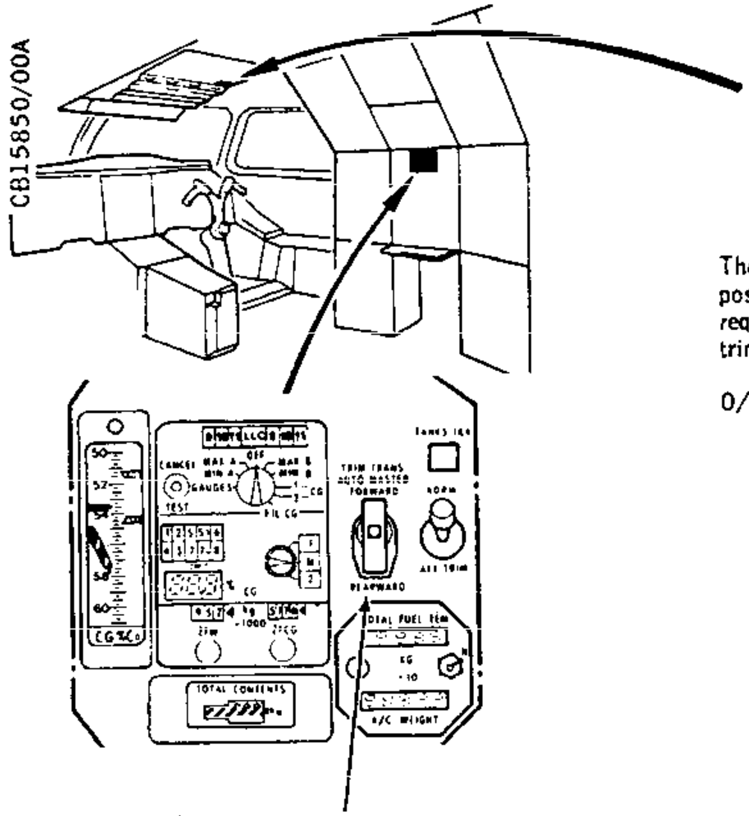
CMB 28 00 00 0 HAMC

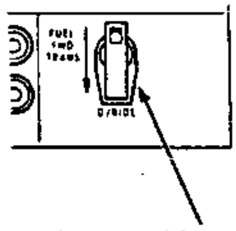
NOTE:
The transfer control valves regulating fuel transfer between tanks 6-1 and tanks 8-4 are additionally controlled by the tank 1 & 4 NORM/AFT switch to give a reduced level in these tanks.

LOW PRESS CAPTION (Yellow)

ILLUMINATED - when tank 8 pump switch set to ON. Extinguished when pump pressure switch is actuated.

\- Sub-system Management (Main Transfer)
(Sheet 3 of 3)
Figure 009





The switch is moved from its guarded position only in an abnormal situation requiring an override of the automatic trim transfer system.

O/RIDE - initiates an automatic forward transfer sequence, provided tank 11 pump selectors and tank 9, 5 and 7 inlet valve selectors are at AUTO, whatever the position of the TRIM TRANS AUTO MASTER selector. The sequence is:-
(a) Tank 11 pumps run.
(b) Tank 9 inlet valves open.
(c) When tank 9 reaches high level, tank 9 inlet valves close and tanks 5 and 7 inlet valves open.

TRIM TRANSFER AUTO MASTER SELECTOR

FORWARD - provided the associated inlet valve and pump selector are at AUTO, initiates an automatic forward transfer sequence as follows:-

(a) Tank 11 pumps run and tank 9 inlet valves open; then, when tank 9 reaches the preset load limit or high level, tank 9 inlet valves close and tanks 5 and 7 inlet valves open.
(b) When tank 11 preset load limit is reached, tank 11 pumps stop and tanks 5 and 7 inlet valves close.

REARWARD - switches and latches off the de-aeration mode of tank 11 left-hand pump and, provided the associated inlet valve and pump selector are at AUTO, initiates the automatic rearward transfer of fuel, as follows:-

(a) Tank 9 pumps run to pump fuel into the trim transfer pipes and tank 11 inlet valves open to allow the fuel into tank 11.
(b) When tank 11 reaches the preset load limit or high level, tank 11 inlet valves close and tank 5 and 7 inlet valves open to allow fuel into tanks 5 and 7 provided their contents are below high level.
(c) When tank 9 is empty and its LOW PRESS lights (yellow) come on, tank 10 pumps run.
(d) When tanks 9 and 10 preset load limit is reached, tanks 9 and 10 pumps stop and tanks 5 and 7 inlet valves close.

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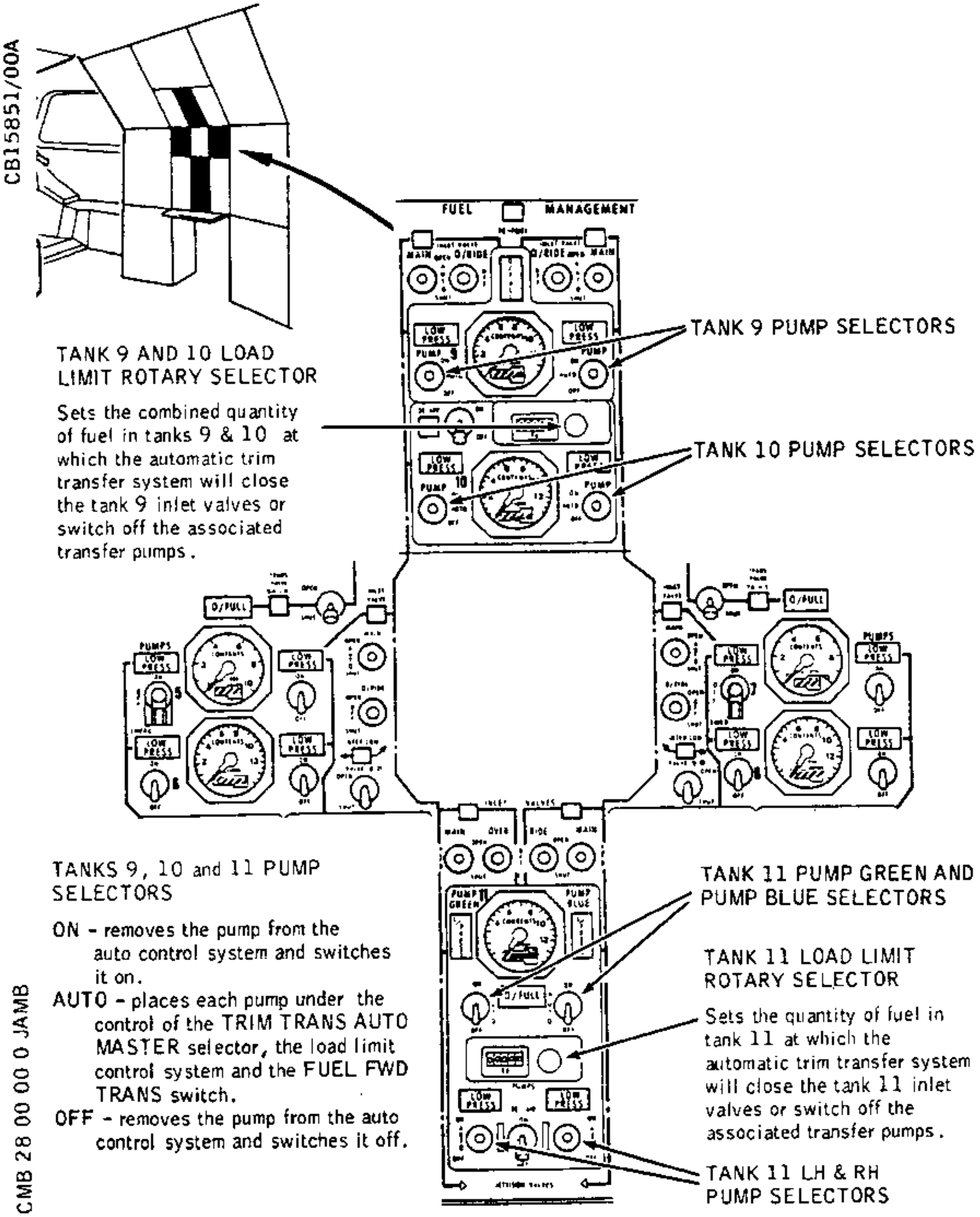
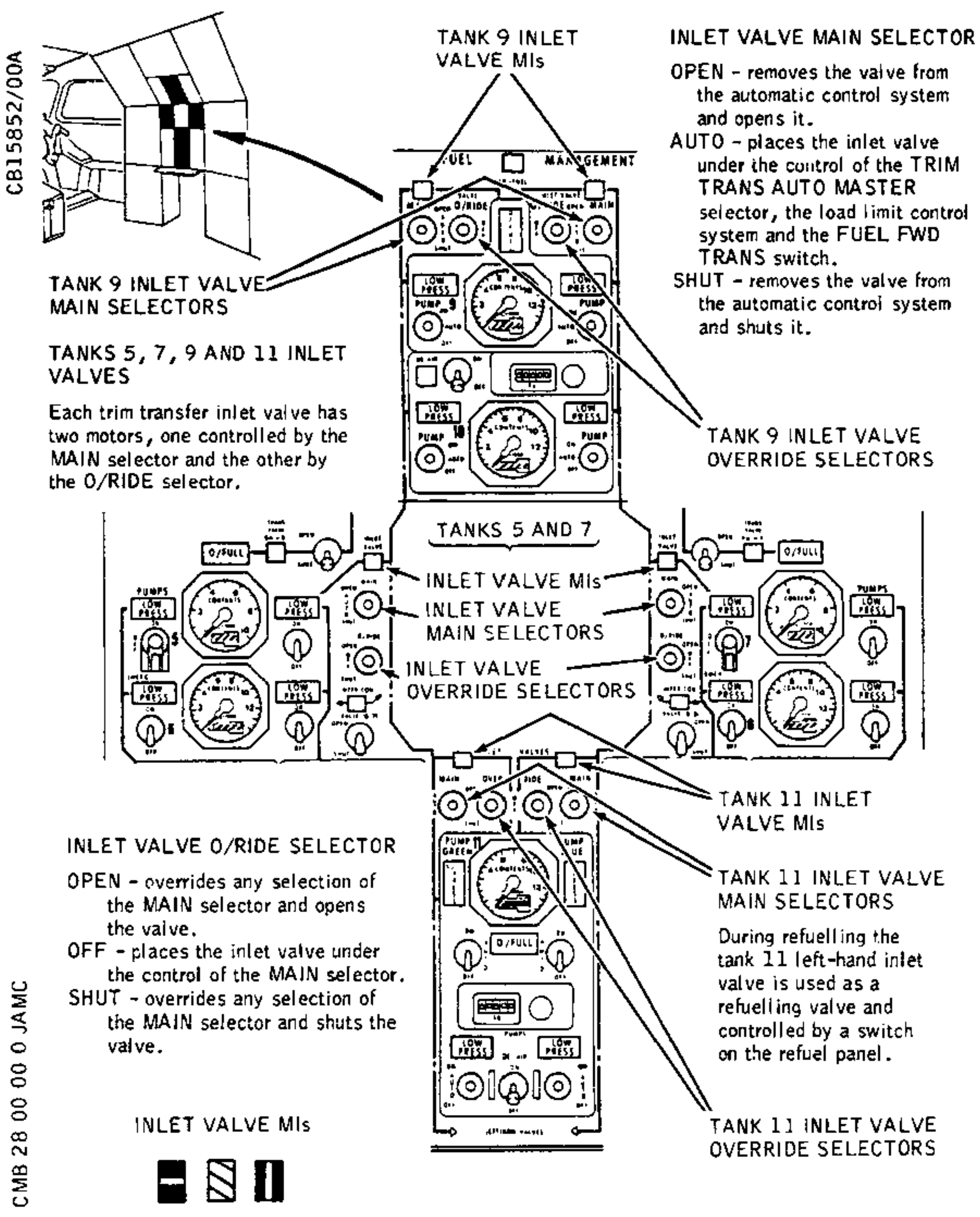
\- Sub-system Management (Trim Transfer)
(Sheet 1 of 4)
Figure 010

R



\- Sub-system Management (Trim Transfer)
(Sheet 2 of 4)
Figure 010

R



\- Sub-system Management (Trim Transfer)
(Sheet 3 of 4)
Figure 010

R

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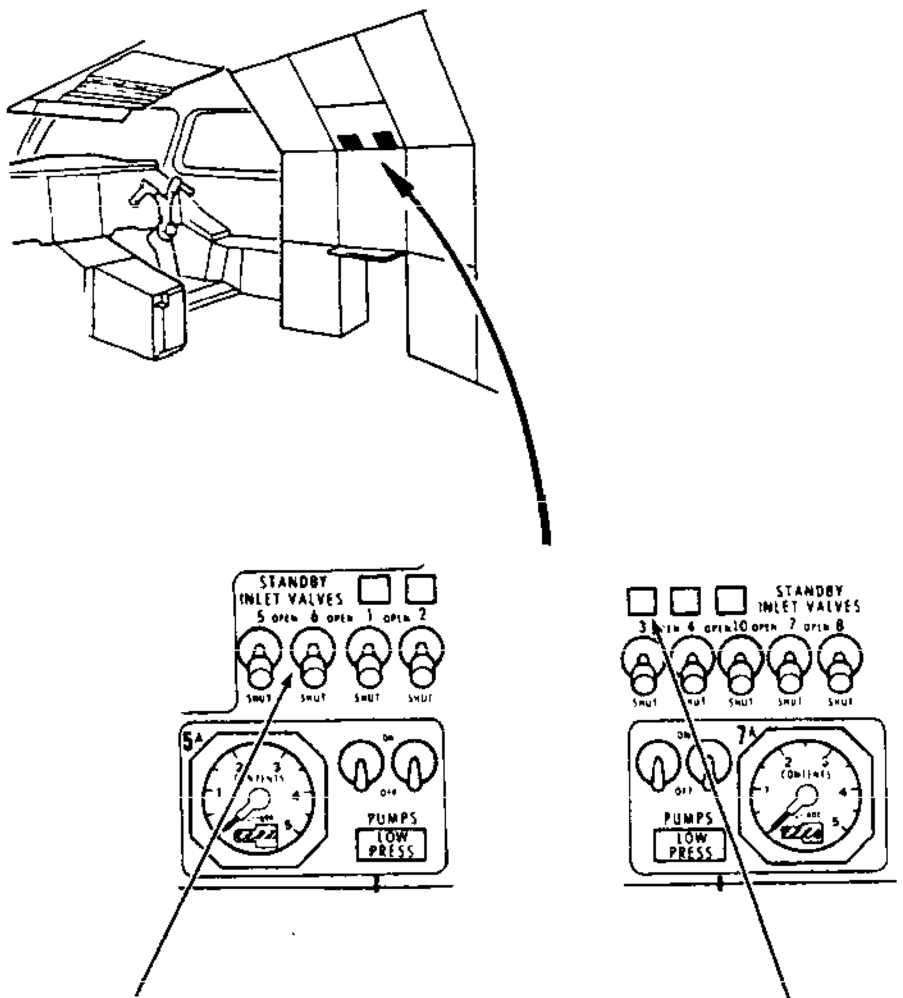

STANDBY INLET VALVES SWITCH

OPEN - allows fuel from the main trim transfer pipe to enter directly into the appropriate tank.

NOTE: During refuelling the standby inlet valves are used as refuelling valves and controlled by switches on the refuel panel.

STANDBY INLET VALVE MIs (TANKS 1, 2, 3, 4 and 10)

OPEN SHUT

These MIs are provided only for those STANDBY INLET VALVES, 1, 2, 3, 4 or 10, that may be used in procedures that require monitoring of the valves.

CMB 28 00 00 0 JAMD

- Sub-system Management (Trim Transfer)
(Sheet 4 of 4)
Figure 010

R

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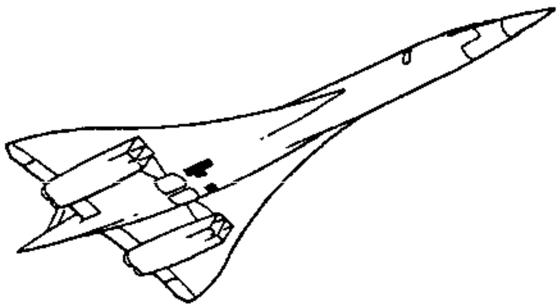
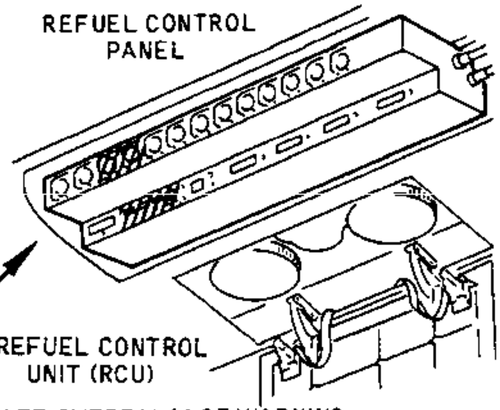




REFUELLING OVERPRESSURE WARNING CAPTION (Amber)

ILLUMINATED - if either of the refuel protection pressure switches operates. The control signal shuts down RCU. Light remains lit until RCU is closed manually.

TRIM VALVE OPEN CAPTION (Amber)

ILLUMINATED - if any one of the trim valves is not fully shut. The control signal shuts down both RCUs.

REFUEL MASTER SWITCH, OFF - DEFUEL - Refer Fig.12

SET-UP - arms the REFUEL VALVE SHUT OFF CHECK test, TPRV EARTH test circuits and transfers FQI indication from management panel to refuel control panel.

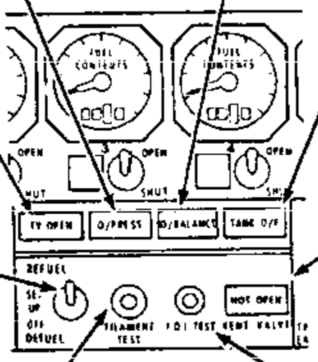
REFUEL - isolates the refuel valve shut-off test and arms the refuelling over-pressure warning circuits. System is set up for refuelling.

AIRCRAFT OVERBALANCE WARNING CAPTION (Amber)

ILLUMINATED - if either of the nose landing gear weight switches fails, or if the refuel tank inlet valve in tank 11 fails to close within 5 s of operation of both weight switches. The control signal shuts down the RCUs.

TANK OVERFULL WARNING CAPTION (Amber)

ILLUMINATED - if overfull condition is reached in any tank with refuel tank inlet valve still open. Control signal shuts down both RCUs.



VENT SHUT-OFF VALVE 'NOT OPEN' WARNING (Amber)

ILLUMINATED - if either or both vent shut-off valves are not fully open.

FILAMENT TEST SWITCH

Press-to-test switch. When pressed, all captions on panel are illuminated to check serviceability of lights.

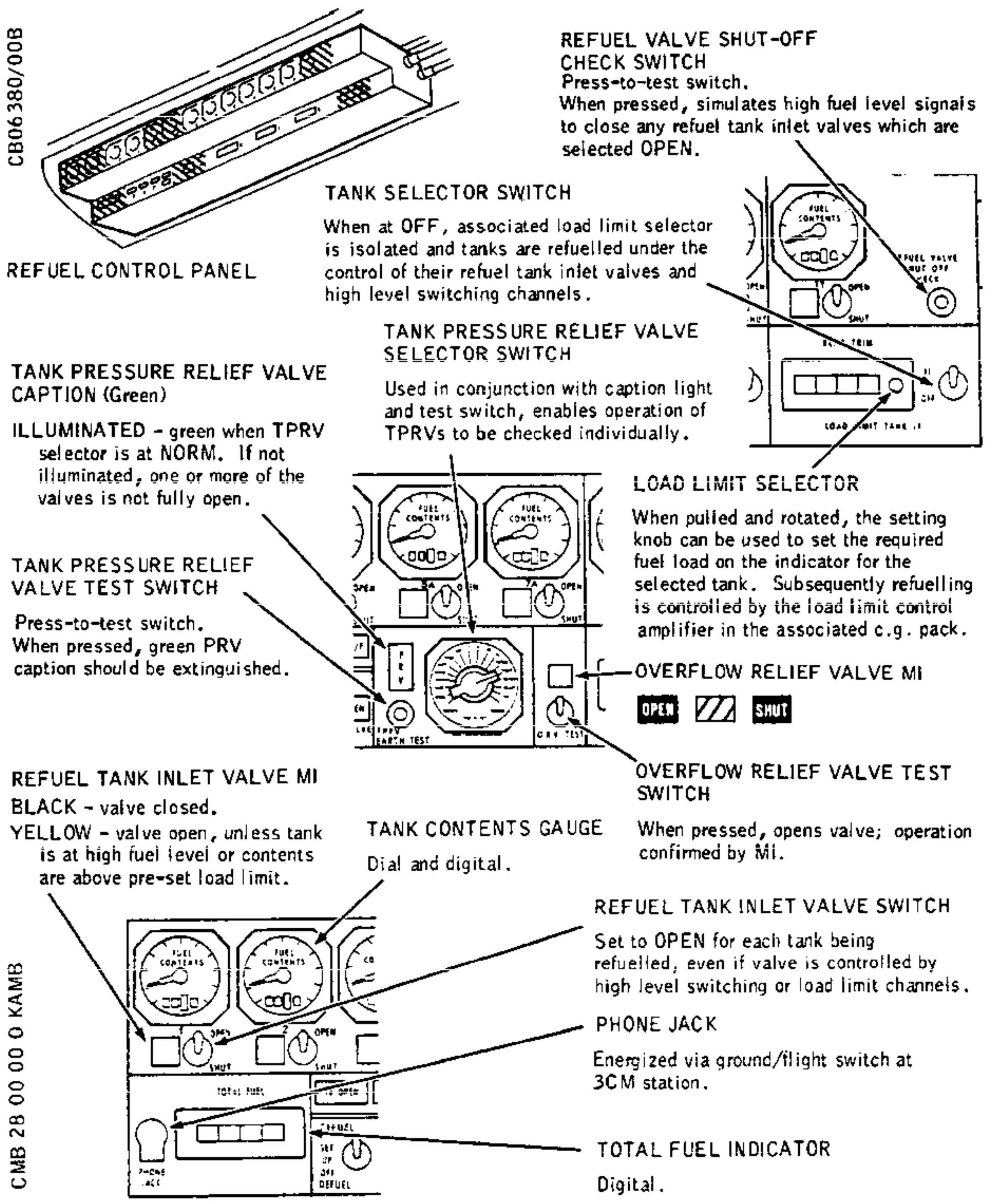
FUEL QUANTITY INDICATION TEST SWITCH

Press-to-test switch. Enables fuel quantity channels to be checked for serviceability. If system is serviceable, tank 11 contents indicator shows increase of 3,000 kg, tanks 5 to 10 show increase of 500 kg, tanks 1 to 4, 5A and 7A show increase of 200 kg and total fuel indicator shows increase of 7,200 kg.

NOTE:
During refuelling operations, the REFUEL MI on the fuel management panel at the 3CM station should indicate GRD. The MI is controlled by the refuel control panel access door microswitch in series with the refuel master switch.

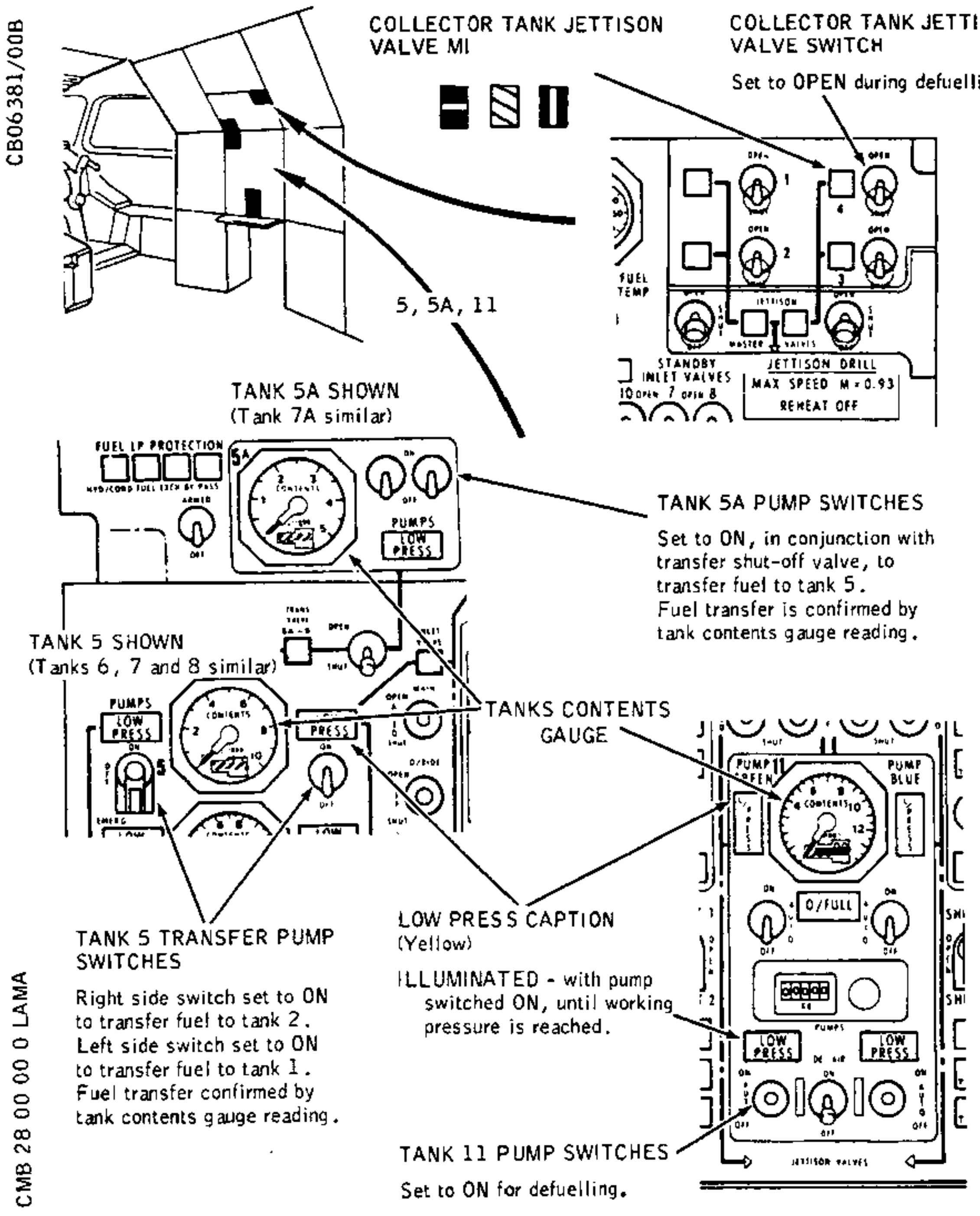
CMB 28 00 00 0 KAMA

\- Sub-system Management (Refuel)
(Sheet 1 of 2)
R Figure 011



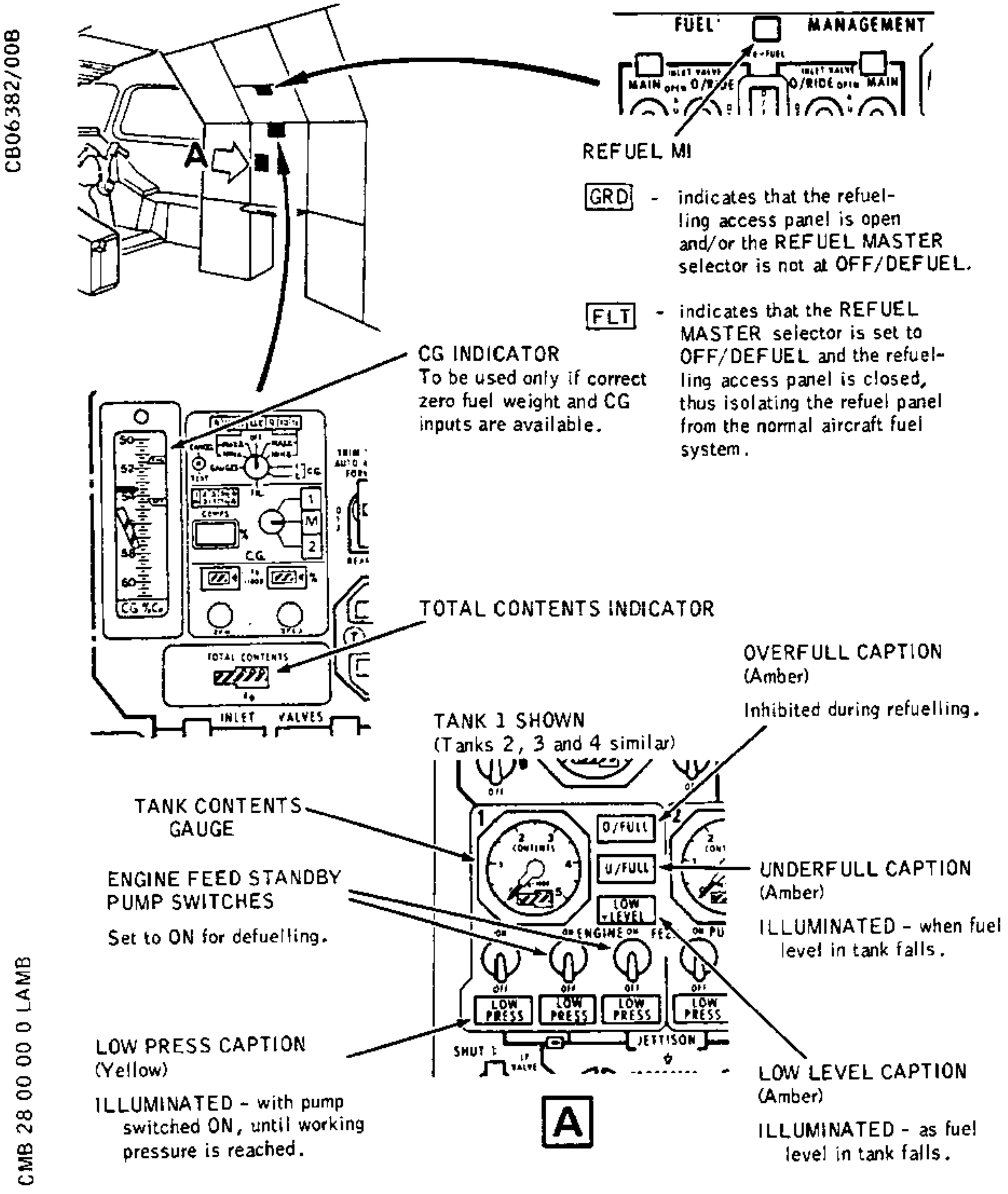
Sub-system Management (Refuel)
(Sheet 2 of 2)
Figure 011

R



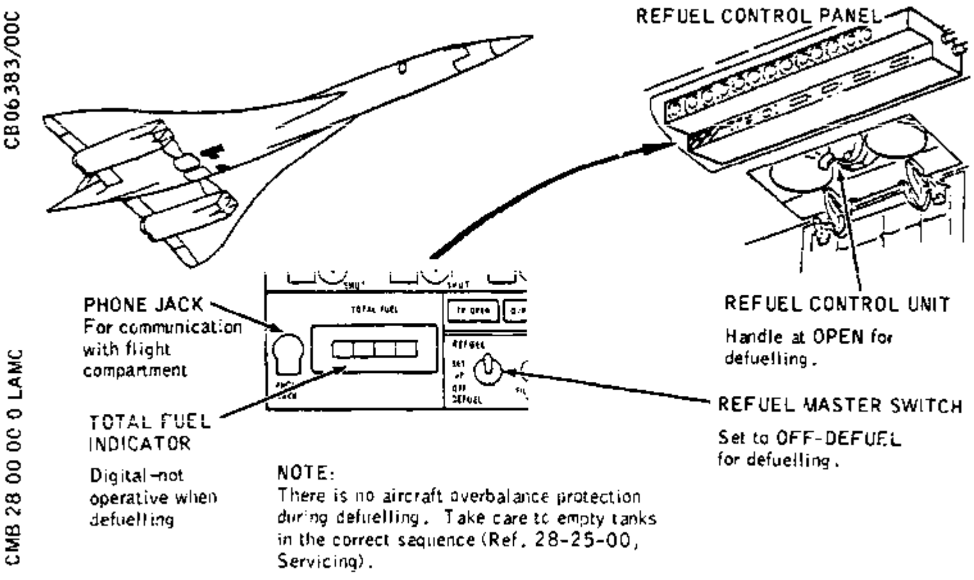
- Sub-system Management (Defuel)
(Sheet 1 of 3)
Figure 012

R

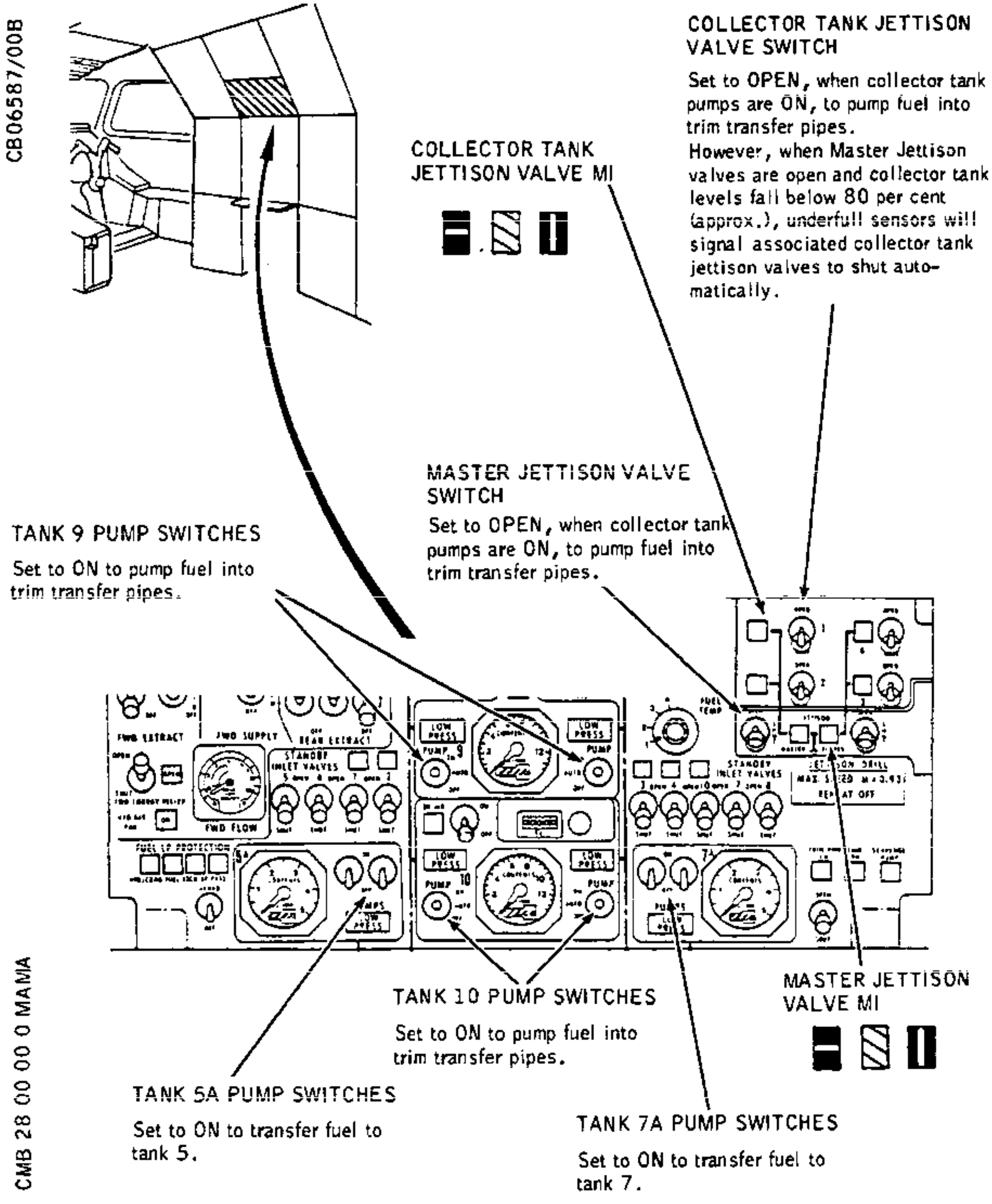


- Sub-system Management (Defuel)
(Sheet 2 of 3)
Figure 012

R

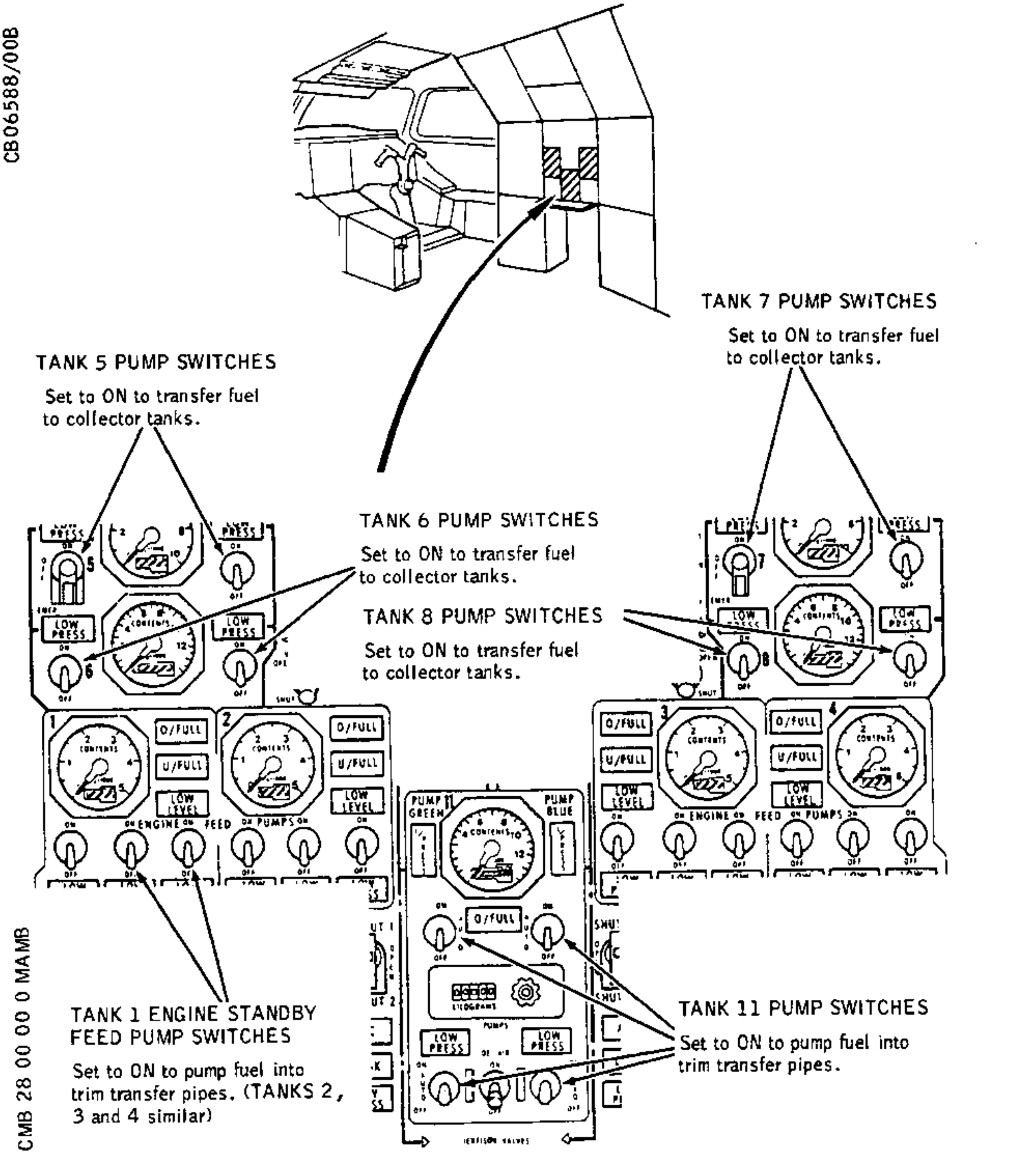


Sub-system Management (Defuel)
(Sheet 3 of 3)
R Figure 012



Sub-system Management (Jettison)
(Sheet 1 of 2)
Figure 013

R



- Sub-system Management (Jettison)
(Sheet 2 of 2)
Figure 013

R

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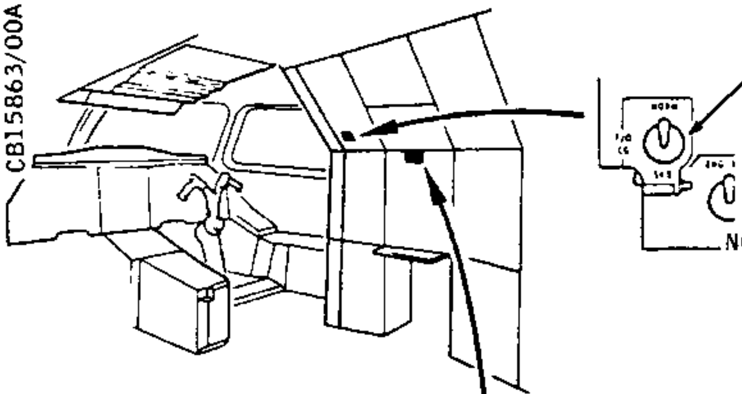


T/O CG SWITCH

NORM - the take-off aft CG boundary used by the M/CG warnings is 53.5%
54% - the take-off aft CG boundary used by the M/CG warnings is 54.0%

NOTE: The switch is latched at 54% but will automatically unlatch and return to NORM when the tank 9 or 10 pumps come on for rearward fuel transfer. Can be operated manually.

CG% Co INDICATOR LIGHT (Red)

On - steady, indicates infringement of either the forward or aft boundary of the defined flight envelope.
On - flashing, indicates infringement of the forward or aft extreme boundary of the defined flight envelope. Accompanied by MWS M/CG light (red), pilot's M/CG lights (red) and audio warning (gong) and, in a certain configuration, by activation of the stick-shaker.

9, 10, 11 CAPTIONS (Yellow)

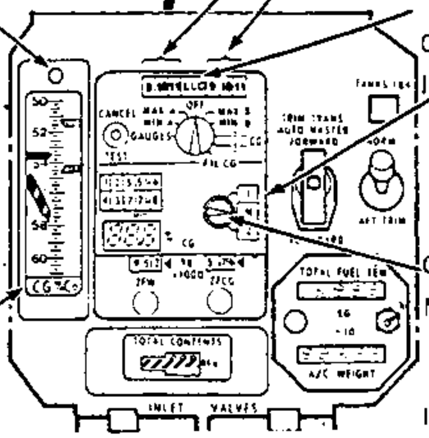
ILLUMINATED - indicates that the failure detector has detected a failure on one of the tank's pair of gauging channels and has disconnected it from the FQI drive.

LLC CAPTION (Yellow)

ILLUMINATED - indicates a disparity between the signals from two load limit control channels.

CG CHANNEL CAPTION (Amber)

ILLUMINATED - indicates a failure of the channel. If the selected channel fails the light is accompanied by a c.g. flag on the machmeters, a failure flag on the c.g. indicators, the MWS CG caption (amber) and audio warning (gong).



CG CHANNEL ROTARY SELECTOR

M - selects the main computer for CG system. The main channel uses inputs of ZFW, ZFCG and all (13) FQIs.
1 - selects standby computer 1 for the CG system. The standby 1 channel uses inputs of ZFW, ZFCG and FQIs for tanks 1, 2, 5, 5A and 6 plus channel A in tanks 9, 10 and 11.
2 - selects standby computer 2 for the CG system. The standby 2 channel uses inputs of ZFW, ZFCG and FQIs for tanks 3, 4, 7, 7A and 8 plus channel B in tanks 9, 10 and 11.

CG% Co INDICATOR (Repeated on captain's instrument panel).

The CG limit bugs are orange pointers labelled FWD and AFT on the right-hand side of the instrument.
The red and black diagonally striped flag appears across the middle of the scale to indicate a servo imbalance, bugs jammed, loss of power supply and loss of validity signal to the CG pointer.

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- Sub-system Management (Quantity and Level Indication)
(Sheet 1 of 4)
Figure 014

R

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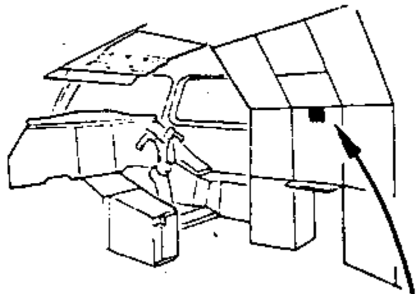
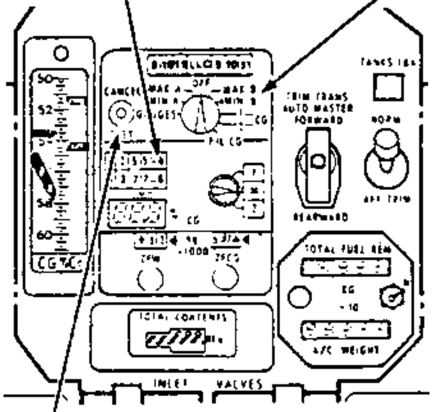


COMPARATOR CAPTIONS (Yellow)

ILLUMINATED - indicates that the fuel quantity in that tank is out of balance with its paired opposite numbers e.g., 1 and 4, 2 and 3.



FQI TEST-CANCEL SWITCH

TEST - Refer to MPR SWITCH operation.

CANCEL - cancels the test and resets the comparator; also resets the comparator and cancels the comparator warning, provided that the difference in the two tanks contents is within the permitted dead band tolerance.

The selector is spring-returned to the centre-off position.

CMB 28 00 00 0 NAMB

MULTI-POSITION ROTARY (MPR) SWITCH

GAUGES - With TEST selected, signals preset quantity increases to all FQIs, as follows:-

Tanks 1, 2, 3, 4, 5A, 7A: 200 ($\pm$50) kg

Tanks 5, 6, 7, 8: 500 ($\pm$100) kg

Tanks 9, 10: 500 ($\pm$150) kg

Tank 11: 3,000 ($\pm$200) kg

There must be no comparator warnings for tanks 9, 10, 11.

NOTE: Total contents indicator reading increases by 7,200 kg.

The result of this apparent weight increase and 1% aft CG shift are indicated on, and test, all aircraft fuel quantity and CG indicators. At the same time the resultant incompatability, between CG and Mach number, tests the MACH/CG warnings, the CG% Co warnings and their connection to the MWS.

MIN A - With ADC 1 & 2 switched on - simulates a fault in the tanks 9, 10 & 11 FQI pointer drive, thus testing the fault detection. The test is latched until CANCEL is selected.

MAX A, MAX B, MIN B - MIN and MAX refer to the two independent comparator circuits that sense FQI failures downward and upward from the correct reading. A and B refer to the duplicated FQI channels of tanks 9, 10, and 11, provided to give adequate reliability to the automatic transfer system.

1 CG - tests the CG computer by causing the 1 CG to go in excess of 1% rearward, thereby testing the 1-M-2 comparator.

2 CG - tests the CG computer by causing the 2 CG to go in excess of 1% rearward, thereby testing the 1-M-2 comparator.

FIL - tests the filaments of the CG digital display.

- Sub-system Management (Quantity and Level Indication)
(Sheet 2 of 4)
Figure 014

R

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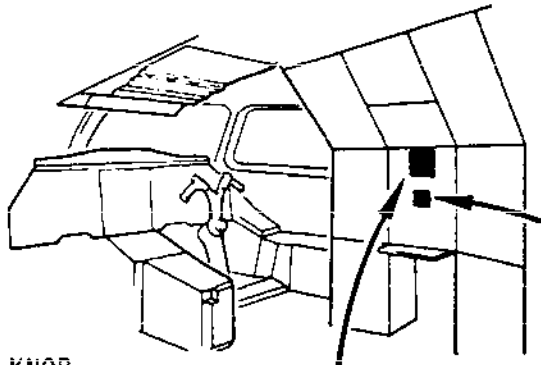
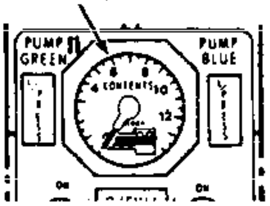


FUEL QUANTITY INDICATOR (TRIM TANKS 9, 10 and 11)

Black bar obscures the digital counter when there is a digital indication failure.

NOTE: During refuelling the supply to the digital indicator motors of the tanks 9, 10 and 11 FQI is transferred to the refuel panel FQI.



LH KNOB

Pulling and releasing, with RH rotary selector at any position other than N, zeroes the TOTAL FUEL REM indicator.
Pressing and holding, with the RH rotary selector at N, tests the digital indicators, which will read all 8s.

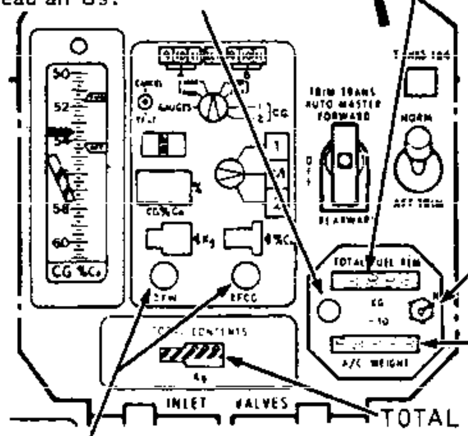
TOTAL FUEL REM DIGITAL INDICATOR

Shows the total fuel by subtracting the fuel consumed readings from the datum setting.

TOTAL FUEL REM AND A/C WEIGHT ROTARY SELECTOR

N - normal position; selector must be set to N in normal use, i.e., after insertion of new values, otherwise the A/C WEIGHT and TOTAL FUEL REM will not operate.

OTHER POSITIONS - the A/C WEIGHT indicator displays five digits, one digit at a time, starting with the least significant. One digit at a time is selected by rotating the rotary selector counter-clockwise from N to the first dot and so on to the fifth dot. At each position the digit number is changed by pressing the left-hand knob. Each press increases the digit value by one.
The setting procedure for the TOTAL FUEL REM indicator is the same as that for A/C WEIGHT, and as the numbers are set in the TOTAL FUEL REM indicator, they will be added to the A/C WEIGHT indication.



A/C WEIGHT DIGITAL INDICATOR

TOTAL CONTENTS INDICATOR

(Repeated on pilot's centre instrument panel).
Shows the total fuel onboard by summing the individual FQI readings.

NOTE: THE TOTAL CONTENTS indicator should not normally be used as a primary source of information, except as required by the FUEL JETTISON procedure, or in the case of flowmeter failure.

ZFW AND ZFCG SETTING KNOBS

Pulled to operate.
Turned clockwise to increase digital readings.
Turned counter-clockwise to decrease digital readings.

CMB 28 00 00 0 NAMC

- Sub-system Management (Quantity and Level Indication)
(Sheet 3 of 4)
Figure 014

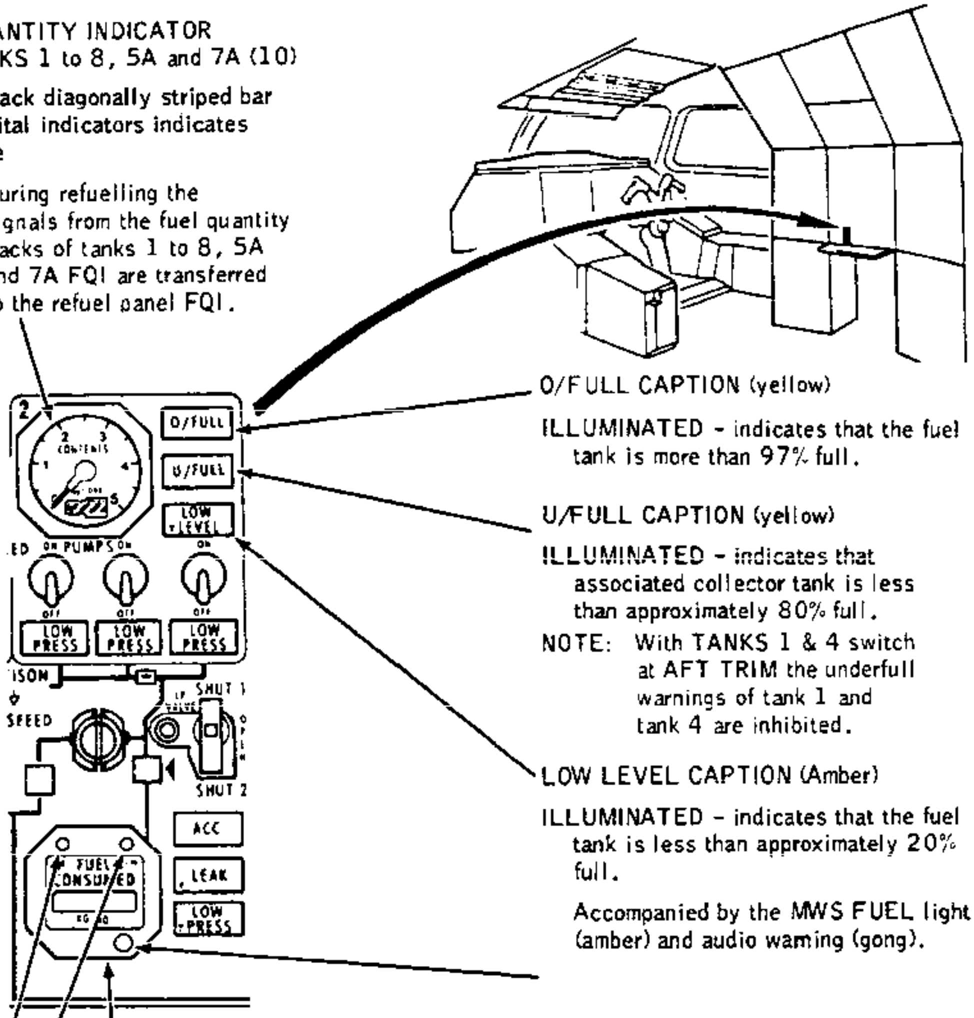
R

CB15861/00A

FUEL QUANTITY INDICATOR
(FOR TANKS 1 to 8, 5A and 7A (10)

Red and black diagonally striped bar across digital indicators indicates FQI failure

NOTE: During refuelling the signals from the fuel quantity packs of tanks 1 to 8, 5A and 7A FQI are transferred to the refuel panel FQI.



O/FULL CAPTION (yellow)

ILLUMINATED - indicates that the fuel tank is more than 97% full.

U/FULL CAPTION (yellow)

ILLUMINATED - indicates that associated collector tank is less than approximately 80% full.

NOTE: With TANKS 1 & 4 switch at AFT TRIM the underfull warnings of tank 1 and tank 4 are inhibited.

LOW LEVEL CAPTION (Amber)

ILLUMINATED - indicates that the fuel tank is less than approximately 20% full.

Accompanied by the MWS FUEL light (amber) and audio warning (gong).

FUEL CONSUMED INDICATOR

Shows the fuel consumed by the engine, integrated from its flow meter.

RESET/TEST KNOB

When pulled and turned counter-clockwise, resets the indicator to zero. When turned clockwise and held for 3 s, tests the filaments of the display.
Then, provided the associated engine is running, when the knob is released the M light (yellow) and R/H light (yellow) are lit for 3 s, to indicate that the density compensation system of the associated fuel flow transmitter is operative. This confirms the integrity of the density compensation and hence the accuracy of the fuel flow signals to the power management lights and reheat control systems.

M (MAIN AND R/H (REHEAT) LIGHT (Yellow)

On - indicates a fault in the density compensation system.

CMB 28 00 00 0 NAMD

- Sub-system Management (Quantity and Level Indication)
(Sheet 4 of 4)
Figure 014

GENERAL - SERVICING

WARNING: BEFORE ANY MAINTENANCE OPERATION IS COMMENCED:

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN PARAGRAPH 2.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE 'AIRCRAFT GROUND STABILITY' PROCEDURES DETAILED IN 12-00-10.

OBSERVE THE AIRCRAFT OVERBALANCE PRECAUTIONS DETAILED IN PARAGRAPH 6.

CHECK THAT THE MASTER JETTISON VALVES ARE SHUT.

WARNING: THERE IS A DANGER WHEN SKIN IS CONTAMINATED WITH KEROSENE OR OTHER AVIATION FUELS.

CONTAMINATION OF THE SKIN BY KEROSENE CAN PRODUCE SERIOUS BURNS. THERE IS A GREATER DANGER OF THIS OCCURRING IF CONTAMINATION AND SOAKED CLOTHING IS LEFT ON THE PERSON.

IMMEDIATE FIRST AID TREATMENT IS ESSENTIAL AND SHOULD CONSIST OF REMOVAL OF THE CONTAMINATED CLOTHING FOLLOWED BY COPIOUS WASHING WITH COLD WATER.

B MEDICAL UNITS AT L.H.R. STATION AND ENGINEERING BASE ARE
B EQUIPPED WITH SHOWER FACILITIES AND CHANGE OF CLOTHING.

1. General

When maintenance operations on the fuel system are being carried out, the safety precautions detailed in paragraph 2. must be observed. These precautions must be read in conjunction with any special notes and precautions that may apply to specific maintenance operations, particularly the following:

Refuelling (Ref. 12-11-28)

Defuelling (Ref. 28-25-00)

Gaining access to tanks (Ref. 28-10-00)

Certain maintenance operations require personnel to wear special protective clothing, this is described in paragraph 3. Many of the instructions for specific maintenance operations refer to the normal ground settings of the fuel management panel switches. These switch settings are detailed in paragraph 4. Paragraph 5. details the normal settings of the refuel control panel switches when the refuelling operation is not being carried out.

There are also many maintenance operations that require fuel to be transferred from one tank to another when the aircraft is on the ground. Precautions and procedures for fuel transfer on the ground are detailed in paragraph 6.

2. Safety Precautions

A. General Precautions

(1) Before any maintenance operation on the fuel system is commenced, the JETTISON MASTER VALVE switches on the fuel management panel must be in the OFF position, with their associated magnetic indicators displaying bar-across-line.

(2) Fuel system maintenance must be carried out in a clear, well ventilated area.

(3) Smoking and use of naked lights in the area are strictly forbidden. 'No Smoking' notices must be prominently displayed in the area.

(4) Adequate and properly manned fire fighting equipment must be provided in accordance with local regulations.

(5) Personnel working in areas of high fume concentration must wear protective clothing and breathing apparatus.

(6) Under no circumstances must anyone start or attempt to start the engines or carry out any other maintenance on the aircraft that is liable to create a safety hazard while the fuel system maintenance is in progress.

(7) Only approved explosion-proof lamps, hand torches and equipment may be used in the maintenance area. Vapour-proof lamps must not be used under any circumstances.

(8) Personnel working in the maintenance area must not:

(a) slide metal objects along the floor (e.g., tool boxes, ladders, etc.),

(b) carry matches or cigarette lighters,

(c) wear shoes with metal clips or exposed nails, or

(d) wear hearing aids or battery-operated equipment.

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B. Technical Precautions

(1) Scrupulous cleanliness must be observed when the fuel system is being maintained.

(2) Blanks must be fitted to exposed pipe ends and component orifices to prevent contamination of the system by foreign particles.

(3) Spilled fuel must be washed or wiped away immediately.

(4) Only approved tissues, e.g., Kimwipe, may be used for drying
RB components, pipes and fittings. For cleaning inside fuel
RB tanks Eurotwill Cloth only is to be used.

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(5) Live electrical cables must not be left disconnected in the aircraft or anywhere in the maintenance area.

(6) The aircraft and any pumping equipment, containers or ground equipment must be electrically grounded.

(7) Electrical equipment must not be connected into live outlets within 100 ft (30.48 m) of an open fuel tank or a puddle of fuel unless such equipment is fitted with explosion-proof plugs.

(8) Electrical testing equipment that can produce sparks must not be used in the maintenance area.

(9) During installation of fuel system components, new O-ring seals, lubricated in accordance with 20-23-11, must be fitted.

R (10) Prior to tank close-up all bonding leads are to be visually
R inspected to ensure their integrity. Any bonding lead that
R is found to be broken, frayed, or with braid loose in the
R crimp is to be replaced before the next flight. Bonding
R leads that show signs of surface corrosion only
R (characterized by sooty deposits or tarnishing) may be left
R installed.

R (11) Any electrical bonding which is disturbed or which may be in
R doubt is to be checked in accordance with 20-27-11.

R (12) If the main trim transfer pipe (MTTP) is being drained of fuel for the purpose of removing valve canisters, refuel control unit (RCU), trim pipe drain valve or associated piping, and there is fuel in tank 9, 10 or 11, there is a possibility that fuel will be siphoned from these tanks via the pump pressure holding valves. Therefore, when the MTTP is being drained the following must be observed:

(a) If the MTTP is being drained via the trim pipe drain valve and the scavenge tank pump, the scavenge pump ceases running in less than 6 min.

(b) If the MTTP is being drained via the trim pipe drain valve and overflow relief valve, or from the RCU, the fuel quantity drained does not exceed approximately 30 gal (136 l) from each MTTP, i.e., approximately 60 gal (272 l) from both.

(c) If the above requirement (Ref. para.(a) or (b), as appropriate) is not met, the following action must be taken:

c1) Tanks 11, 10 and 9 must be defuelled (Ref. 28-25-00, Servicing), or

c2) The pump element(s) must be removed to allow the canister slide valve to shut and stop the fuel flow (Ref. 28-23-31, 28-23-51 and 28-23-53).

3. Protective Clothing and Equipment (Ref. Fig.301)

Protective clothing to be worn by personnel working in or around fuel tanks must consist of the following:

A. One-piece overalls made of a cotton-based material and free from any exposed steel buttons, buckles, fasteners or loose ends liable to be caught up in internal structure or to drop off. Overalls made of wool, silk, nylon or any synthetic material must not be used. The overalls must be tightly fitting around the wrists and ankles and all pockets must be emptied especially the breast pockets. Approved kerosene suits may be used if available.

B. A tee shirt and shorts, made of cotton, under the overalls.

C. A cotton cap or suitable head covering.

D. Overshoes made of either canvas or a cotton-based material. The soles of overshoes must be kept clean.

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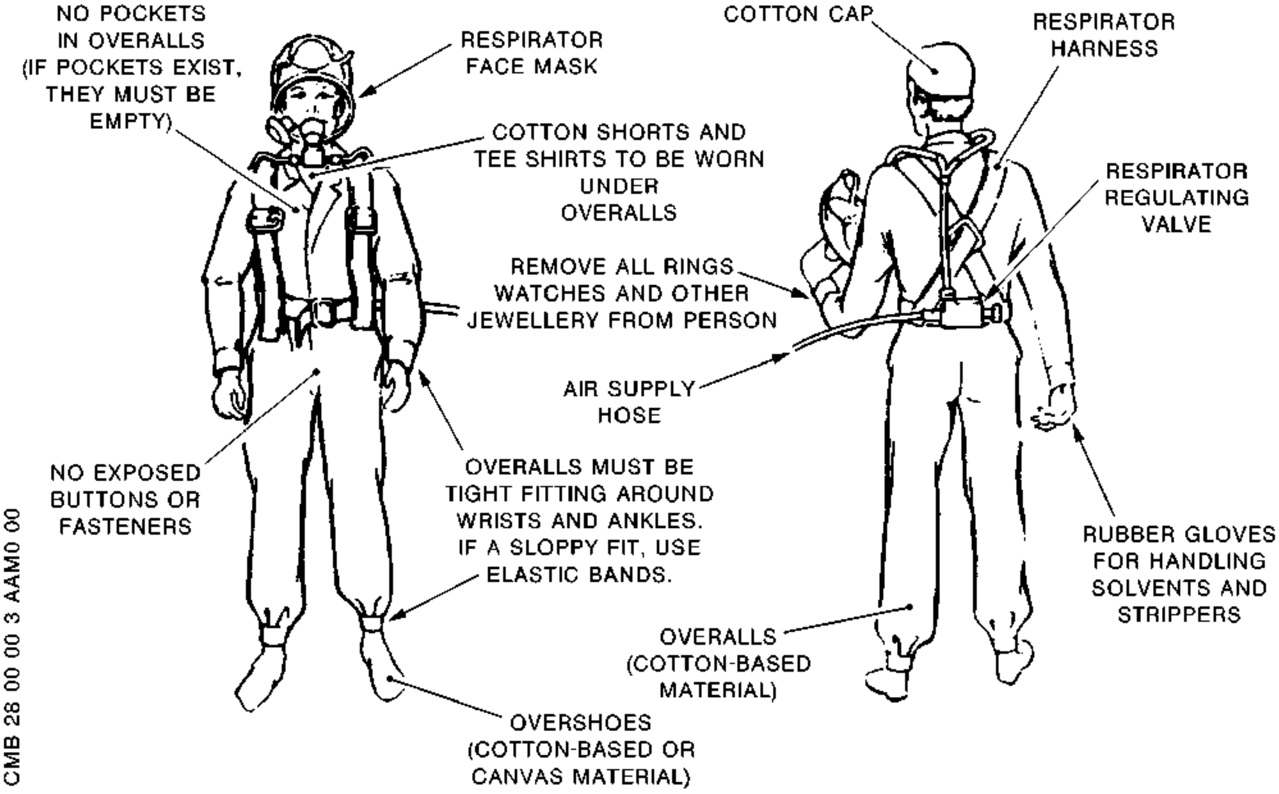

Protective Clothing and Equipment
Figure 301

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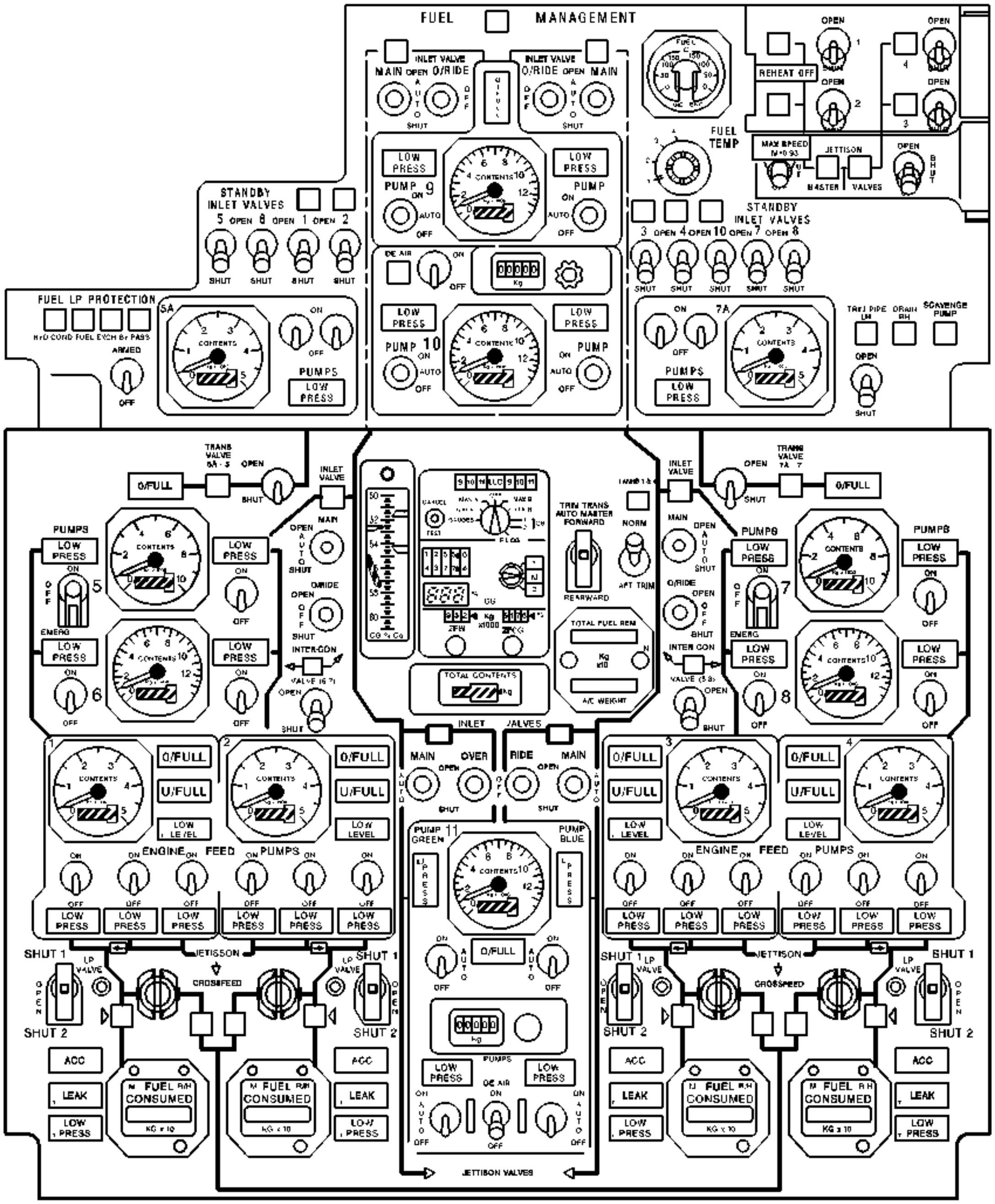
When solvents and strippers are being handled, rubber gloves must be worn, and any remaining exposed areas of skin must be protected with barrier cream.

Goggles must be worn when solvents and strippers are being handled, unless breathing apparatus incorporating a full-face mask is being worn.

4. Fuel Management Panel Switches - Ground Settings (Ref. Fig.302)

The normal ground settings of the fuel management panel switches (Ref. Fig.302) are listed in Table 301. For switches with associated magnetic indicators, the table also lists the indicator display when the switch is at its normal ground setting and electrical ground power is switched on.



Fuel Management Panel - Switches at Normal
Ground Settings
Figure 302

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SWITCH	SETTINGS	GROUND SETTING	INDICATOR DISPLAY
FUEL LP PROTECTION	ARMED, OFF	OFF	Black
Main transfer system:			
Tanks 5A, 6, 7A and 8 PUMPS, and tanks 5 and 7 RH PUMPS	ON, OFF	OFF	-
Tanks 5 and 7 LH PUMPS	ON, OFF, EMERG	OFF	-
TRANS VALVES, 5A-5, 7A-7	OPEN, SHUT	SHUT	Cross-line
INTER-CON VALVES, 6-7 and 5-8	OPEN, SHUT	SHUT	SHUT
Jettison system:			
Collector tank jettison valves	OPEN, SHUT	SHUT	Cross-line
JETTISON MASTER VALVES	OPEN, SHUT, OFF	OFF	Cross-line
Trim transfer system:			
TRIM TRANS AUTO MASTER	FORWARD, OFF, REARWARD	OFF	-
B Tanks 9 and 10 PUMPS	ON, AUTO, OFF	OFF	-
B Tank 11 GREEN and BLUE PUMPS	ON, AUTO, OFF	OFF	-
B Tank 11 electric PUMPS LH and RH	ON, AUTO, OFF	OFF	-
ALL STANDBY INLET VALVES	OPEN, SHUT	SHUT	SHUT
TRIM PIPE DRAIN valves	OPEN, SHUT	SHUT	SHUT

Fuel Management Panel Switches - Ground Settings
Table 301 (continued)

SWITCH	SETTINGS	GROUND SETTING	INDICATOR DISPLAY
B Tanks 9, 5, 7 and 11 INLET VALVES MAIN	OPEN, AUTO, SHUT	SHUT	
Tanks 9, 5, 7 and 11 INLET VALVES O/RIDE	OPEN, OFF, SHUT	OFF	Cross-line
TANKS 1 and 4 NORM - AFT TRIM	NORM, AFT TRIM	NORM	NORM
Engine feed system:			
Tanks 1, 2, 3 and 4 ENGINE FEED PUMPS	ON, OFF	OFF	-
Tanks 1, 2, 3 and 4 LP VALVES	SHUT 1, OPEN, SHUT 2	OPEN	In-line
Tanks 1, 2, 3 and 4 CROSS-FEED valves	Cross-line, in-line	Cross-line (SHUT)	Cross-line
De-aeration system:			
Tank 10 DE-AIR pump	ON, OFF	OFF	OFF
Tank 11 trim pump DE-AIR	ON, OFF	OFF	-
FQI test:			
CANCEL/TEST	CANCEL, mid-position, TEST	Mid-position	-
Channel test	GAUGES, MIN A, MAX A, OFF, MAX B, MIN B, 1CG, 2CG	OFF	-

Fuel Management Panel Switches - Ground Settings
Table 301 (continued)

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SWITCH	SETTINGS	GROUND SETTING	INDICATOR DISPLAY
Refuel control panel access door microswitch	-	-	GRD (access door open) or FLT (access door shut and refuel master switch at OFF/DEFUEL)

Fuel Management Panel Switches - Ground Settings
Table 301 (concluded)

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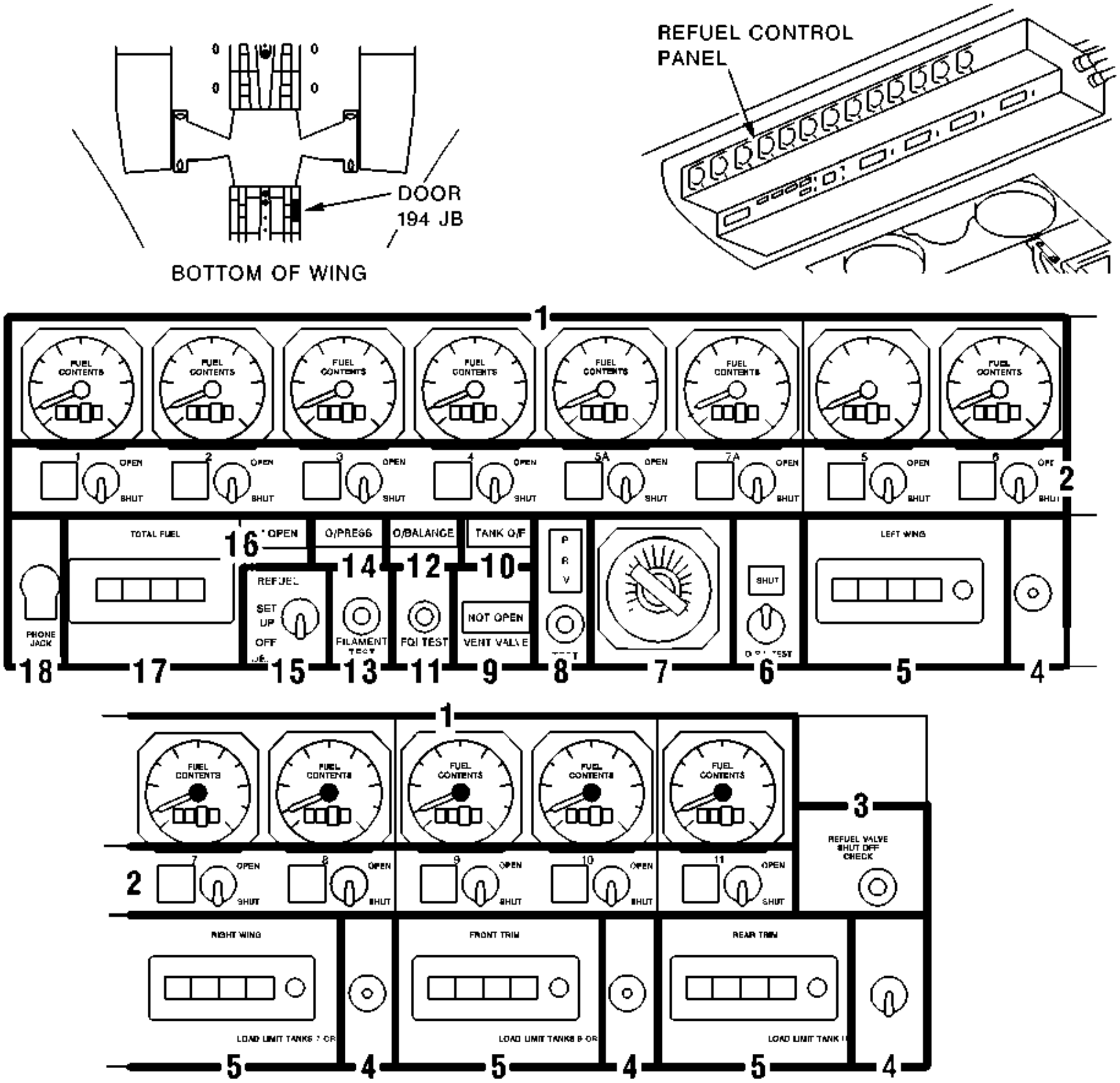
5. Refuel Control Panel Switches (Ref. Fig.303)

The normal settings of the refuel control panel switches (Ref. Fig.303), before and after a refuelling operation, are listed in Table 302. For switches with associated magnetic indicators, the table also lists the indicator display when the switch is at its normal setting and electrical ground power is switched on.

NOTE: When the refuel control panel access door is opened, the refuel magnetic indicator at the top of the fuel management panel (3CM station) changes its display from FLT to GRD.

SWITCH	NORMAL SETTING	INDICATOR DISPLAY
Refuel valves, tanks 1 to 11 inclusive	SHUT	Black
Tank selectors, tanks 5/6, 7/8, 9/10 and 11	OFF	-
TPRV selector	NORMAL	-
Refuel master	OFF/DEFUEL	-

Refuel Control Panel Switches
Table 302



1 FUEL QUANTITY INDICATOR
2 REFUEL VALVE SWITCH AND INDICATOR
3 REFUEL VALVE SHUT-OFF CHECK SWITCH
4 TANK SELECTOR SWITCH
5 LOAD LIMIT CONTROL SELECTOR
6 ORV TEST SWITCH AND INDICATOR
7 TPRV SELECTOR SWITCH
8 TPRV EARTH TEST SWITCH
9 VENT VALVE NOT OPEN WARNING CAPTION
10 TANK OVERFULL WARNING CAPTION
11 FUEL QUANTITY INDICATOR TEST SWITCH
12 AIRCRAFT OVERBALANCE WARNING CAPTION
13 FILAMENT TEST SWITCH
14 REFUELLING OVERPRESSURE WARNING CAPTION
15 REFUEL MASTER SWITCH
16 TRIM VALVE OPEN WARNING CAPTION
17 TOTAL FUEL QUANTITY INDICATOR
18 PHONE JACK

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Refuel Control Panel
Figure 303

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6. Fuel Transfer on the Ground (Ref. Fig.304)

WARNING: TRANSFER OF FUEL IN A REARWARD DIRECTION OR REFUELLING REAR TANKS (Ref. Fig.304) MAY CAUSE AIRCRAFT OVERBALANCE, UNLESS THE FOLLOWING PRECAUTIONS ARE OBSERVED.

NOTE: During ground maintenance operations, particular care must be taken to ensure that the aircraft does not become tail-heavy, i.e., that the c.g. does not approach too closely the overbalance position of 56.9% Co (the position of the main landing gear).

A recommended c.g. position is 53.5% Co which is represented on the illustration (Ref. Fig.304) by a line near tanks 5 and 8 rear bulkheads. For the purpose of reference within this topic, tanks 1, 4, 5, 8, 9 and 10 are considered 'front' tanks (forward of the line) and tanks 2, 3, 6, 7, 5A, 7A and 11 are considered 'rear' tanks (to the rear of the line).

Fuel may be transferred from the rear tanks, singly or in any combination, to the front tanks regardless of the aircraft fuel distribution.

Forward fuel transfer, i.e., fuel transfer from any tank to another in a forward direction may take place regardless of the aircraft fuel distribution.

A. Overbalance Precautions - Aircraft on its Wheels and Normally Equipped

(1) The Zero Fuel Centre of Gravity (ZFCG) must be well forward of 56.9% Co. To achieve this, the aircraft must be complete, with passenger seats fitted and rear galleys and baggage hold empty.

(2) A tail steady must be in position before rearward transfer of fuel and it must be adjusted progressively during the operation to avoid excessive load at the point of support.

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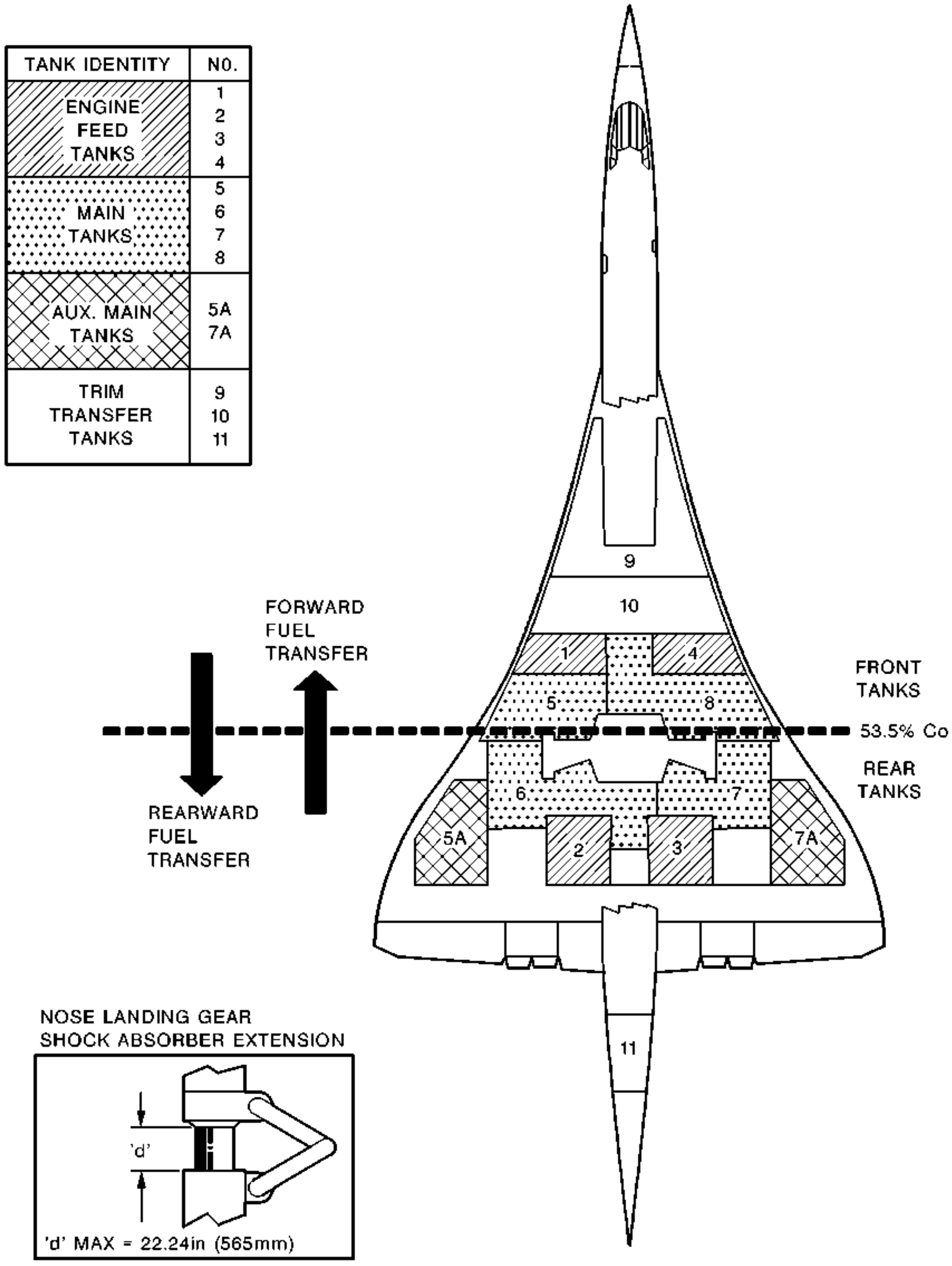

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Fuel Tanks Layout
Figure 304

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(3) The fuel c.g. must be maintained forward of 56.9% Co by observance of the following requirements, during rearward transfer of fuel, or refuelling the rear tanks:

(a) For rearward transfer of fuel to a tank or tanks other than tank 11:

a1) Tank 11 must initially be empty and remain so.

a2) The total weight of fuel in the front tanks must always be at least 15,000 kg more than that in the rear tanks.

(b) For transfer of fuel into tank 11:

b1) Tank 11 must be initially empty.

b2) Fuel must first be transferred from tanks 2, 3, 6, 7, 5A and 7A to tanks 9, 10, 1, 4, 5 and 8.

b3) Tanks 9, 10, 1 and 4 must be full.

b4) Fuel remaining in tanks 2, 3, 6, 7, 5A and 7A not required for transfer to tank 11 must be removed by defuelling (Ref. 28-25-00).

(4) The extension of the nose landing gear shock absorber must be monitored during fuel transfer. If the extension (dimension 'd') (Ref. Fig.304) reaches 22.24 in (565 mm), fuel transfer must be stopped immediately and fuel redistributed to the front tanks to correct this condition.

(5) As an additional precaution, if the Zero Fuel Weight (ZFW) and ZFCG can be accurately determined by reference to the Weight and Balance Manual, these values should be set into the c.g. indicator (Ref. 28-44-00, Description and Operation) on the fuel management panel (3CM station) and the indicator monitored during each fuel movement operation.

B. Overbalance Precautions - Aircraft on Jacks (including Tail Steady) and Incomplete

(1) The ZFCG must be forward of 65.3% Co, i.e., all the following major items must be in place:

Nose and visor

Nose landing gear

Main landing gear

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(2) The fuel c.g. must be maintained forward of 56.9% Co and fuel may be moved only after due observance of the precautions that apply to fuel movement in an aircraft on its wheels (Ref. para.A.(3)).

C. Fuel Transfer Procedures

(1) Fuel may be transferred from any tank in the aircraft by using the tank pump(s) and opening the appropriate valve(s) to allow ingress to another tank. Table 303 details the normal fuel transfer paths, the pumps and valves to be used, and the Maintenance Manual topic reference.

FROM TANK	TO TANK	VIA	PUMP	M/M REF
Collector tank 1, 2, 3 or 4	Tank 1, 2, 3 or 4	Crossfeed valves of both tanks	Main ENGINE FEED pump	28-21-13, Adjustment/Test
Collector tank 1, 2, 3 or 4	Tank on same side	Collector tank jettison valve, MTTP* and inlet valve	Standby ENGINE FEED pump	28-21-13, Adjustment/Test
Main transfer tank 5, 6, 7 or 8	Tank 1, 2, 3 or 4	Transfer control valve	Main transfer pump	28-22-21, Adjustment/Test
Aux. main transfer tank 5A or 7A	Tank 5 or 7	Transfer shut-off valve	Aux. main transfer pump	28-22-22, Adjustment/Test
Trim transfer tank 9, 10 or 11	Tank 5, 7, 9 or 11	Trim INLET VALVE	Trim transfer pump	28-23-00, Adjustment/Test

*Main trim transfer pipe

Fuel Transfer on the Ground
Table 303

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GENERAL - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

A. Introduction

This topic contains general instructions for the removal and installation of minor electrical components, fitted to panels, relay boxes and contactor boxes, that are common to sub-systems within Chapter 28. Panels, relay boxes and contactor boxes and the associated minor electrical components are as follows:-

Lower fuel panel (5-214) (3CM station):

Switches, caption light modules, magnetic indicators, diodes and indicator lamps.

Upper fuel panel (2-214) (3CM station):

Switches, caption light modules and magnetic indicators.

Refuel panel (1-194) (lower fillet):

Switches, caption light modules and magnetic indicators.

Left fuel relay box (15-123) (forward underfloor racking):

Relays and diodes.

Right fuel relay box (18-123) (forward underfloor racking):

Relays and diodes.

Left fuel contactor box (22-123) (forward underfloor racking):

Relays and contactors.

Right fuel contactor box (24-123) (forward underfloor racking):

Relays and contactors.

B. Fuel and Refuel Panel Components (Ref. Fig.401 and 402)

NOTE: Reference should be made to Table 401 for key to Figure 401, and to Table 402 for key to Figure 402.

Switches, magnetic indicators and diodes are mounted from the rear of the appropriate panel, access being made by lowering the panel on its hinges. Caption light modules are mounted from the front of the panel and clamped to the panel from the rear.

Cable formers, which act as panel strengthening supports on the rear of each panel, support cable looms and terminal blocks which may restrict access to components, terminals or connectors. These cable looms and terminal blocks may be temporarily moved to allow easier access to electrical components. To remove and install a magnetic indicator, it is necessary to withdraw the associated electroluminescent panel (Ref. Chap.33) sufficiently to gain access to the magnetic indicator securing screws.

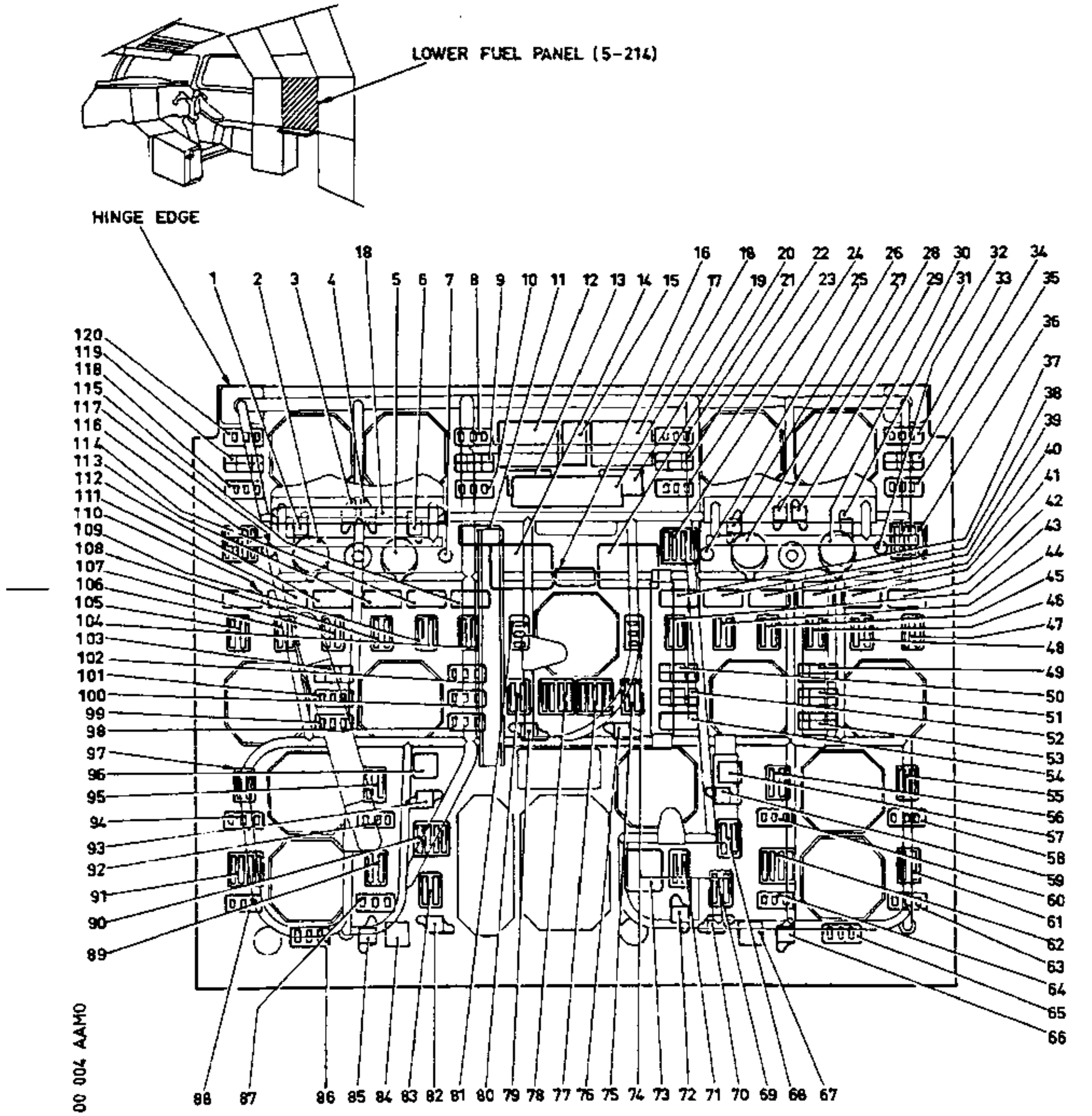
Electrical connections to toggle switches, push-switches, caption light modules and magnetic indicators are made to screw-type or socket-type terminals, and to rotary switches by flying leads. Diodes have soldered connections.

C. Relay Box and Contactor Box Components (Ref. Fig.403 and 404)

The relay and contactor boxes are mounted in the forward underfloor racking in zone 123. Sufficient cable is provided to allow each box to be withdrawn from the racking for individual component removal without electrically disconnecting the box from the aircraft wiring, thus subsequent test procedures require a test of only the associated circuit or component.

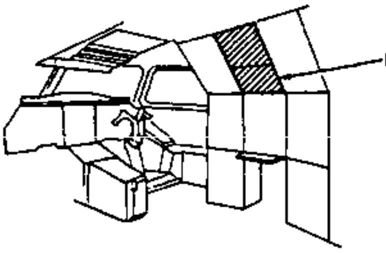
Components within the boxes are mounted on one side of a vertical chassis with the associated wiring assembled on the reverse side. Access to components in the contactor boxes is gained by removing the associated side cover from the box. The relay boxes are not fitted with side covers, therefore direct access to the relays is possible. The diodes in each relay box are mounted on an insulating board, fitted to the chassis by distance pillars, and protected by a diode cover.

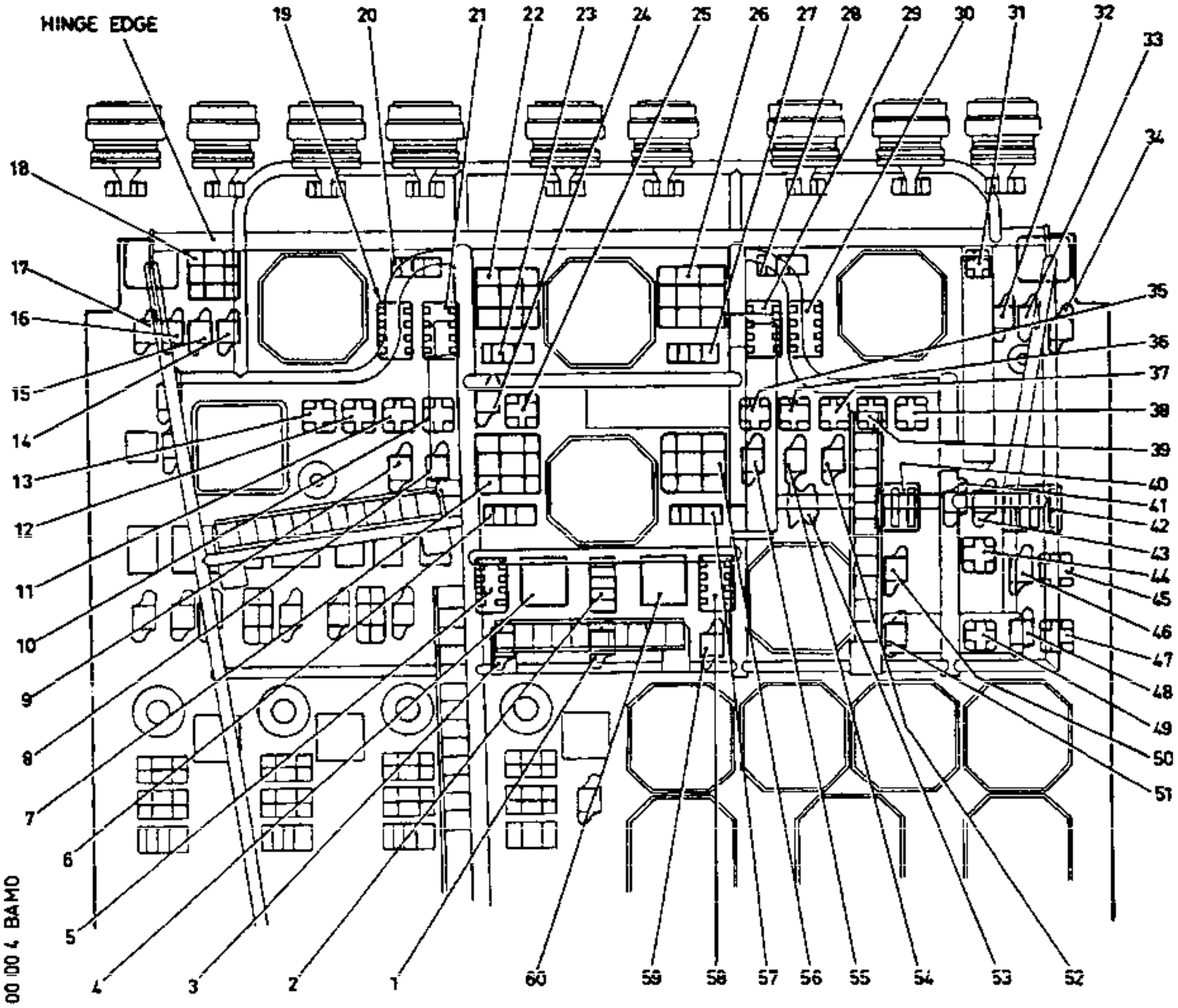
Relays are plug-in type, each being secured to its base



FOR KEY TO MINOR ELECTRICAL COMPONENTS REFER TO TABLE 401

Lower Fuel Panel (5-214) - Diagrammatic
Rear View
Figure 401





FOR KEY TO MINOR ELECTRICAL COMPONENTS REFER TO TABLE 402

CMB 28 00 00 4 BAMO

Upper Fuel Panel (2-214) - Diagrammatic
Rear View
Figure 402

by nuts and washers, or by a spring clamp. Diodes have terminal tags crimped to wire ends which are connected to mounting studs with securing nuts and washers.

KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
1	Indicator - magnetic, valve position, tank 1	1Q7
2	Switch - rotary, engine 1	1Q42
3	Indicator - magnetic, engine 1	1Q43
4	Indicator - magnetic, engine 2	2Q43
5	Switch - rotary, engine 2	2Q42
6	Indicator - magnetic, valve position, tank 2	2Q7
7	Lamp - indicator	2Q8
8	Caption - LOW PRESS, engine 2	2Q462
9	Caption - LEAK, engine 2	2Q82
10	Caption - ACC, engine 2	2Q765
11	Switch - with guard, valve, tank 2	2Q5
12	Switch - left pump, tank 11	Q1383
13	Caption - LOW PRESS, tank 11 left	Q1391
14	Switch - pump control and indication, tank 11, Green	1Q195
15	Switch - change-over, de-air	Q1393
16	Caption - O/FULL, tank 11	Q1237
17	Switch - right pump, tank 11	Q1384
18	Diodes	Various
19	Caption - LOW PRESS, tank 11 right	Q1392
20	Switch - pump control and indication, tank 11, Blue	2Q195

KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
21	Caption - LOW PRESS, engine 3	3Q462
22	Caption - LEAK, engine 3	3Q82
23	Caption - ACC, engine 3	3Q765
24	Switch - with guard, valve, tank 3	3Q5
25	Lamp - indicator	3Q8
26	Indicator - magnetic, valve position, tank 3	3Q7
27	Switch - rotary, engine 3	3Q42
28	Indicator - magnetic, engine 3	3Q43
29	Indicator - magnetic, engine 4	4Q43
30	Switch - rotary, engine 4	4Q42
31	Indicator - magnetic, valve position, tank 4	4Q7
32	Lamp	4Q8
33	Caption - LOW PRESS, engine 4	4Q462
34	Caption - LEAK, engine 4	4Q82
35	Caption - ACC, engine 4	4Q765
36	Switch - with guard, valve, tank 4	4Q5
37	Caption - LOW PRESS, tank 3, main	3Q837
38	Caption - LOW PRESS, tank 3, 1st stby	3Q838
39	Caption - LOW PRESS, tank 3, 2nd stby	3Q839
40	Caption - LOW PRESS, tank 4, 2nd stby	4Q839
41	Caption - LOW PRESS, tank 4, 1st stby	4Q838
42	Caption - LOW PRESS, tank 4 main	4Q837
43	Switch - 3, main	3Q840

KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
44	Switch - 3, 1st stby	3Q841
45	Switch - 3, 2nd stby	3Q842
46	Switch - 4, 2nd stby	4Q842
47	Switch - 4, main	4Q840
48	Switch - 4, 1st stby	4Q841
49	Caption - LOW LEVEL, tank 4	Q1225
50	Caption - LOW LEVEL, tank 3	Q1236
51	Caption - U/FULL, tank 4	Q1224
52	Caption - U/FULL, tank 3	Q1235
53	Caption - O/FULL, tank 4	Q1223
54	Caption - O/FULL, tank 3	Q1234
55	Switch - tank 8-4, forward	Q931
56	Switch - tank 8-3, aft	Q932
57	Switch - valve control, tanks 5, 8	Q875
58	Caption - LOW PRESS, 8-4, forward	Q919
59	Indicator - magnetic, valve position, tanks 5-8	Q873
60	Caption - LOW PRESS, tanks 8, 3, aft	Q920
61	Switch - tanks 7, 4, forward	Q929
62	Switch - tanks 7, 3, aft	Q930
63	Caption - LOW PRESS, tanks 7, 4, forward	Q917
64	Caption - LOW PRESS, tanks 7, 3, aft	Q918
65	Caption - O/FULL, tank 7	Q1230
66	Indicator - magnetic, valve position, tanks 7A, 7	Q6676

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KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
67	Switch - valve control, tanks 7A, 7	Q6672
68	Switch - o/ride, tank 7	Q385
69	Switch - tank 7, main	Q386
70	Indicator - magnetic, tank 7	Q392
71	Switch - main transfer control	Q2102
72	Indicator - magnetic, main transfer control	Q2103
73	Switch - master transfer	Q387
74	Caption - LOW PRESS, Blue, tank 11	2Q199
75	Switch - tank 11, RH, main	Q382
76	Indicator - magnetic, tank 11, RH	Q394
77	Switch - o/ride, tank 11, RH	Q380
78	Switch - o/ride control, LH	Q379
79	Indicator - magnetic, tank 11, LH	Q393
80	Switch - tank 11, LH, main	Q381
81	Caption - LOW PRESS, Green, tank 11	1Q199
82	Indicator - magnetic, tank 5	Q391
83	Switch - tank 5, main	Q384
84	Switch - valve control, tanks 5A, 5	Q6671
85	Indicator - magnetic, transfer valve, tanks 5A, 5	Q6675
86	Caption - O/FULL, tank 5	Q1229
87	Caption - LOW PRESS, tanks 5, 2, aft	Q916
88	Caption - LOW PRESS, tanks 5, 1, forward	Q915
89	Switch - tank 5-2, aft	Q928

KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
90	Switch - tank 5, o/ride	Q383
91	Switch - tanks 5, 7, forward	Q927
92	Caption - LOW PRESS, tanks 6, 2, aft	Q922
93	Indicator - magnetic, valve position, tanks 6, 7	Q874
94	Caption - LOW PRESS, tanks 6, 1, forward	Q921
95	Switch - tanks 6, 2, aft	Q934
96	Switch - valve control, tanks 6, 7	Q876
97	Switch - tanks 6, 1, forward	Q933
98	Caption - O/FULL, tank 2	Q1231
99	Caption - O/FULL, tank 1	Q1226
100	Caption - U/FULL, tank 2	Q1232
101	Caption - U/FULL, tank 1	Q1227
102	Caption - LOW LEVEL, tank 2	Q1233
103	Caption - LOW LEVEL, tank 1	Q1228
104	Switch - 2, main	2Q840
105	Switch - 1, 1 main	1Q840
106	Switch - 1, 1st stby	1Q841
107	Switch - 1, 2nd stby	1Q842
108	Switch - 2, 2nd stby	2Q842
109	Switch - 2, 1st stby	2Q841
110	Caption - LOW PRESS, pump, tank 1, main	1Q837
111	Caption - LOW PRESS, pump, tank 1, 1st stby	1Q838
112	Caption - LOW PRESS, pump, tank 1, 2nd stby	1Q839

KEY NO.	MINOR ELECTRICAL COMPONENTS - LOWER FUEL PANEL	EQUIP. IDENT.
113	Caption - LOW PRESS, pump, tank 2, 2nd stby	2Q839
114	Caption - LOW PRESS, pump, tank 2, 1st stby	2Q838
115	Caption - LOW PRESS, pump, tank 2, main	2Q837
116	Switch - with guard, valve, tank 1	1Q5
117	Lamp	1Q8
118	Caption - ACC, engine 1	1Q765
119	Caption - LEAK, engine 1	1Q82
120	Caption - LOW PRESS, engine 1	1Q462

Minor Electrical Components on Lower Fuel Panel (Ref. Fig.401)
Table 401

KEY NO.	MINOR ELECTRICAL COMPONENTS - UPPER FUEL PANEL	EQUIP. IDENT.
1	Indicator - magnetic, refuel panel door position	Q659
2	Caption - O/FULL, tank 9	Q1222
3	Indicator - magnetic, tank 9, LH	Q390
4	Switch - tank 9, LH o/ride	Q375
5	Switch - tank 9, LH, main	Q377
6	Caption - LOW PRESS, tank 9, LH	1Q197
7	Switch - pump control, tank 9, LH	1Q193
8	Indicator - magnetic, tank 2	Q656
9	Indicator - magnetic, tank 1	Q654
10	Switch - FD control, tank 2	Q575

KEY NO.	MINOR ELECTRICAL COMPONENTS = UPPER FUEL PANEL	EQUIP. IDENT.
11	Switch - FD control, tank 1	Q573
12	Switch - FD control, tank 6	Q571
13	Switch - FD control, tank 5	Q569
14	Indicator - magnetic, bypass, engine 4	4Q764
15	Indicator - magnetic, bypass, engine 3	3Q764
16	Indicator - magnetic, bypass, engine 2	2Q764
17	Indicator - magnetic, bypass, engine 1	1Q764
18	Switch - Arm	Q763
19	Switch - tank 5A, outer	Q923
20	Caption - LOW PRESS, tank 5A	Q913
21	Switch - tank 5, inner	Q924
22	Switch - pump control, tank 10	1Q194
23	Caption - LOW PRESS, tank 10	1Q198
24	Indicator - magnetic, de-air pump	Q6674
25	Switch - de-air pump control	Q6670
26	Switch - pump control, tank 10, RH	2Q194
27	Caption - LOW PRESS, tank 10, RH	2Q198
28	Caption - LOW PRESS, tank 7A	Q194
29	Switch - tank 7A, inner	Q925
30	Switch - tank 7A, outer	Q926
31	Switch - trim pipe drain	Q702
32	Indicator - magnetic, trim pipe drain	Q703
33	Indicator - magnetic, trim pipe drain	Q706

KEY NO.	MINOR ELECTRICAL COMPONENTS - UPPER FUEL PANEL	EQUIP. IDENT.
34	Indicator - magnetic, scavenge pump	Q494
35	Switch - FD control, tank 3	Q574
36	Switch - FD control, tank 4	Q572
37	Switch - FD control, tank 10	Q567
38	Switch - FD control, tank 8	Q570
39	Switch - FD control, tank 7	Q568
40	Switch - master control, A	1Q305
41	Indicator - magnetic, master, A	1Q309
42	Switch - master control, B	2Q305
43	Indicator - magnetic, master, B	2Q309
44	Switch - jettison valve, tank 2	Q140
45	Switch - jettison valve, tank 3	Q141
46	Indicator - magnetic, jettison valve, tank 3	Q137
47	Switch - jettison valve, tank 4	Q142
48	Indicator - magnetic, jettison valve, tank 4	Q133
49	Switch - jettison valve, tank 1	Q139
50	Indicator - magnetic, jettison valve, tank 2	Q136
51	Indicator - magnetic, jettison valve, tank 1	Q135
52	Indicator - magnetic, tank 10	Q658
53	Switch - temporary selector	D3
54	Indicator - magnetic, tank 4	Q655
55	Indicator - magnetic, tank 3	Q657
56	Switch - pump control, tank 9, RH	2Q193

KEY NO.	MINOR ELECTRICAL COMPONENTS - UPPER FUEL PANEL	EQUIP. IDENT.
57	Caption - LOW PRESS, tank 9	2Q197
58	Switch - main, tank 9, RH	Q378
59	Indicator - magnetic, tank 9, RH	Q389
60	Switch - o/ride, tank 9, RH	Q376

Minor Electrical Components on Upper Fuel Panel (Ref. Fig.402)
Table 402

2. Upper Fuel Panel, Lower Fuel Panel and Refuel Panel Components
(Ref. Fig. 401, 402 and 405)
(Ref. Fig. 406)

CAUTION: WHEN INSTALLING ELECTRICAL COMPONENTS, THE TORQUE LOADING OF TERMINAL SECURING DEVICES FOR CERTAIN COMPONENTS MUST BE CARRIED OUT IN ACCORDANCE WITH 20-27-14.

ELECTROLUMINESCENT (EL) PANELS ARE VULNERABLE TO DAMAGE BY SCRATCHING AND CRACKING. ENSURE THAT TOOLS USED IN THE FOLLOWING OPERATIONS DO NOT DAMAGE THE POLISHED WALLS OF THE EL PANELS.

A. Control Failure Indicator Lamp Filament Renewal

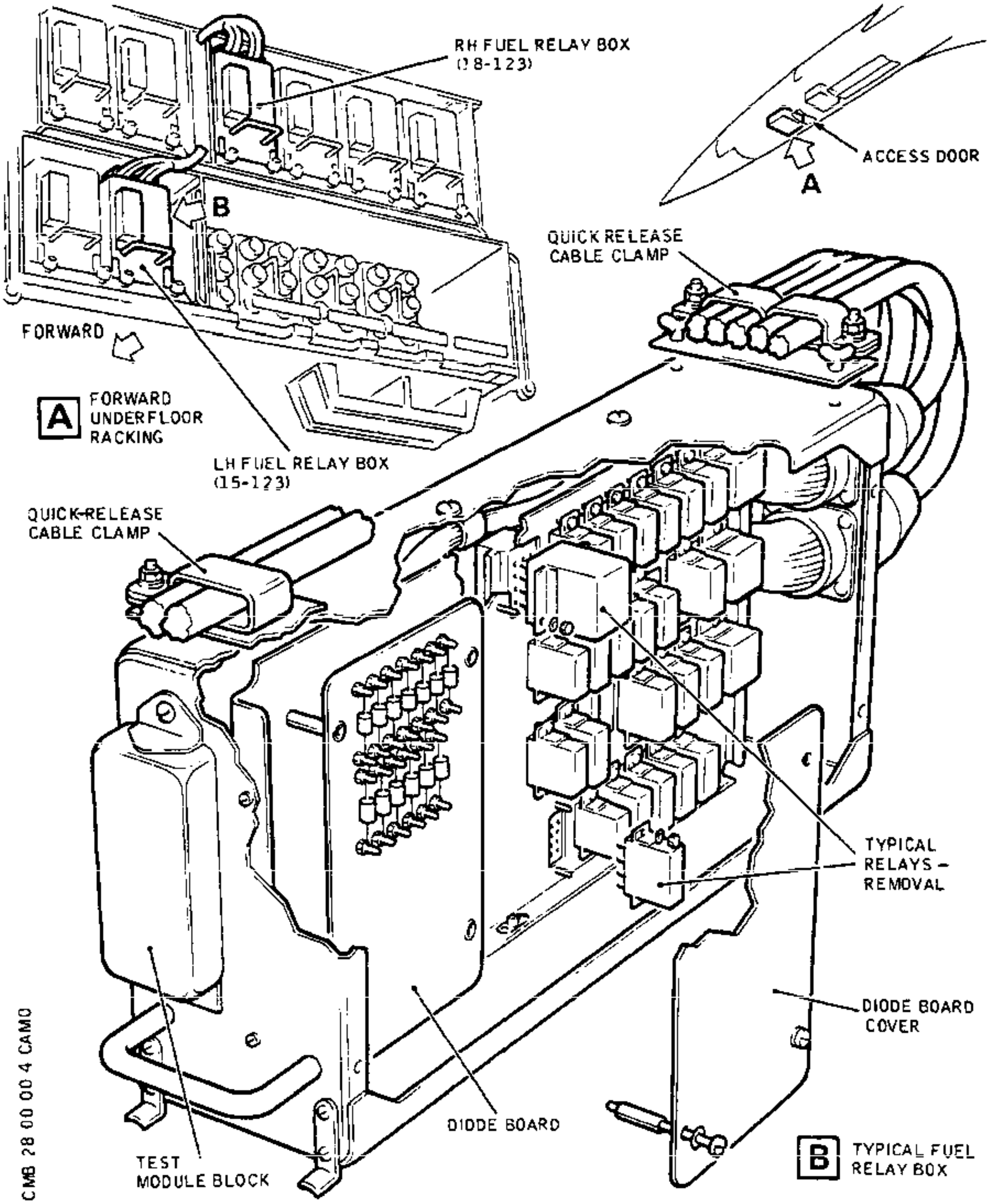
(1) Ensure that the associated valve control switch is at the OPEN position.

(2) Unscrew the indicator lamp cap from the lamp-holder (lower fuel panel only), and remove the cap, complete with filament, from the front of the panel.

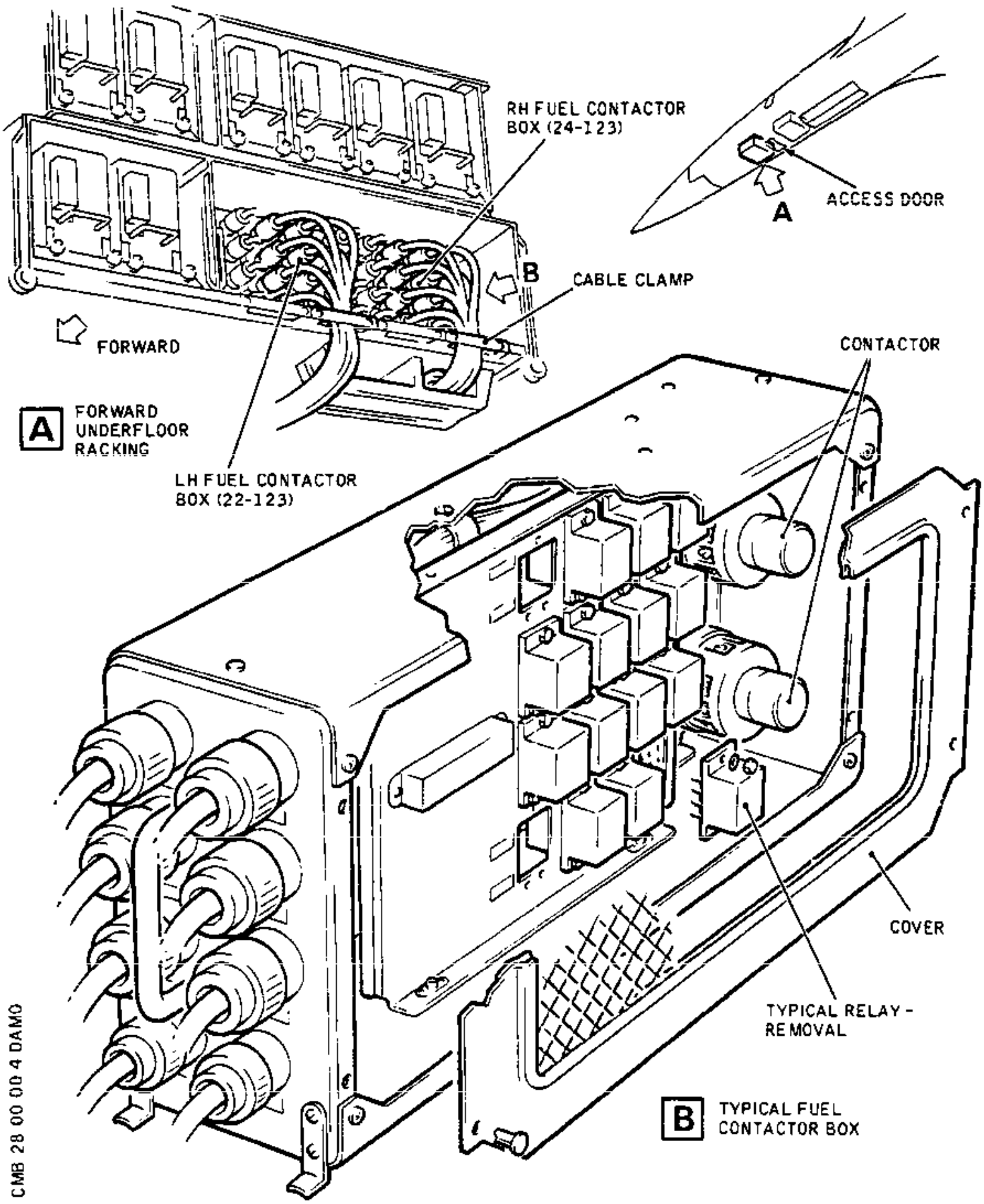
(3) Withdraw the filament from the cap and fit a replacement filament.

(4) Screw the lamp cap complete with filament in the lamp-holder.

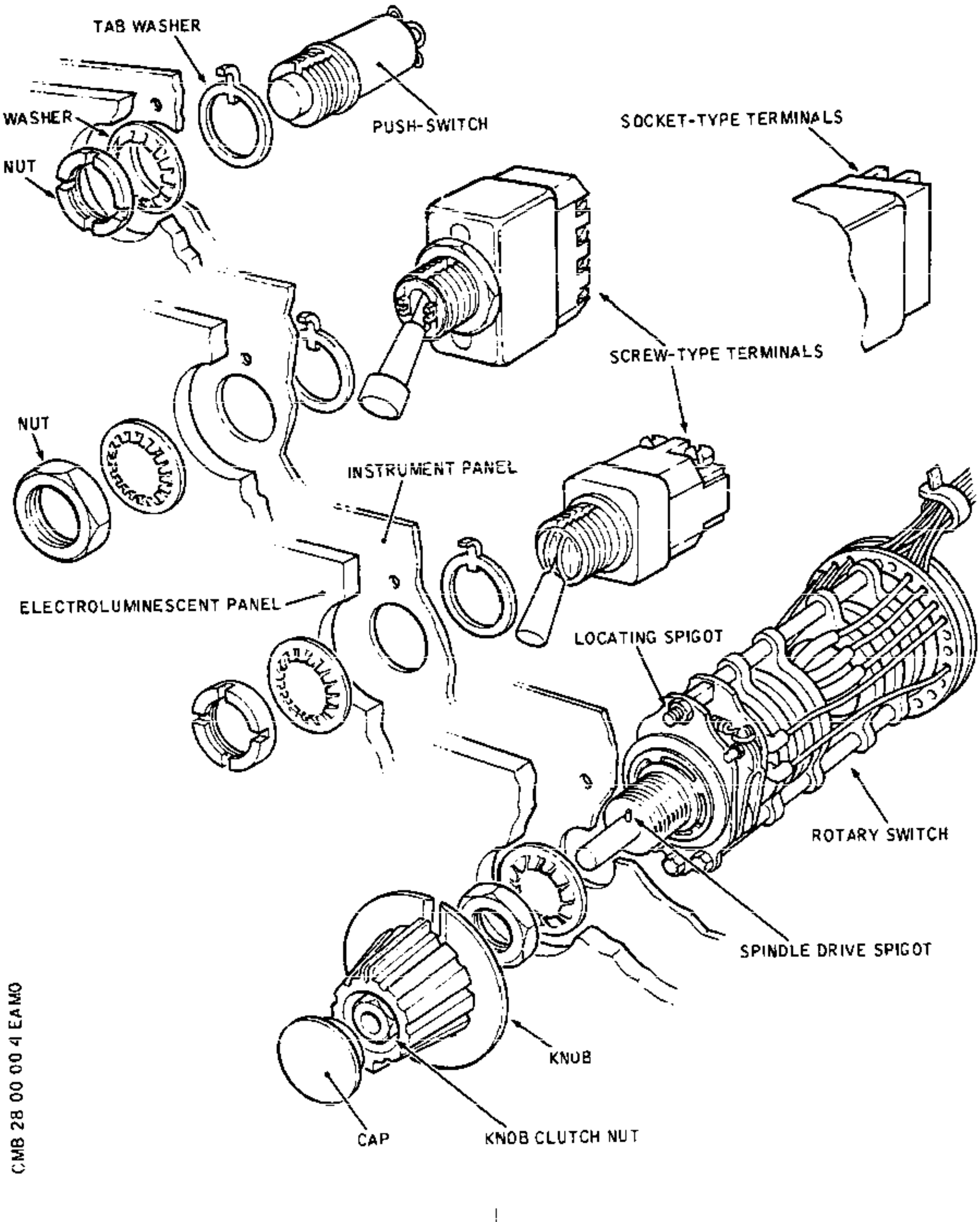
B. Equipment and Materials



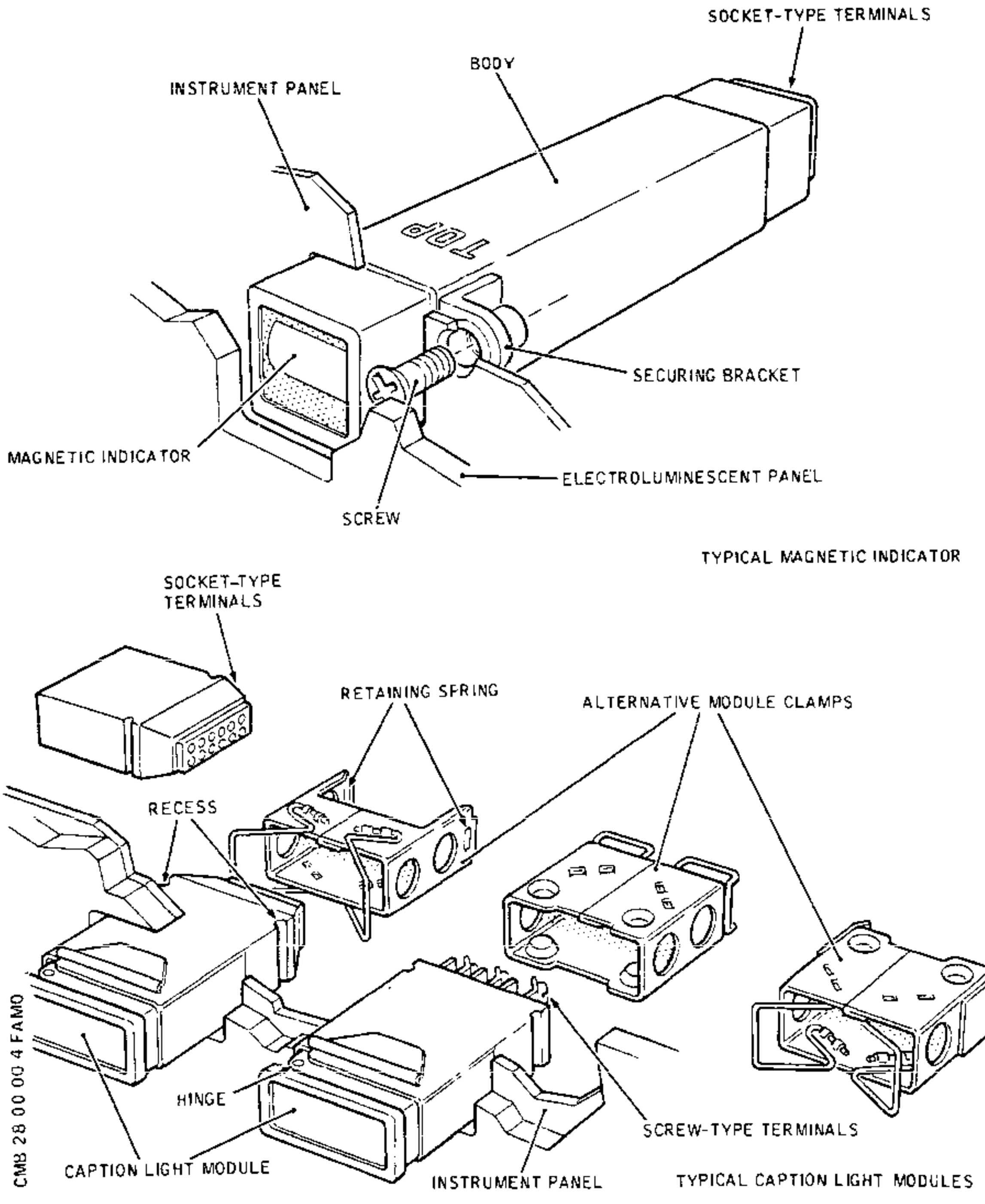
Fuel Relay Box Components
Figure 403



Fuel Contactor Box Components
Figure 404



Switches - Installation
Figure 405



- Magnetic Indicator and Caption Light Modules -
Installation
Figure 406

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

C. Prepare

NOTE: On electrical components with socket-type terminals, the pin inserts must be disconnected and connected in accordance with the Wiring Diagram Manual, 20-42-18.

(1) For components on the upper and lower fuel panels, other than the control failure indicator lamps, isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing. For components on the refuel panel, trip the circuit breakers listed below and fit safety clips.

NOTE: Reference should be made to Table 401 for the key to Figure 401, and to Table 402 for the key to Figure 402.

R The following components on the refuel control panel have their own Removal/ Installation topics:-

R Refuel panel door microswitch (Ref. 28-24-61)

R Tank pressure relief valve indication selector switch (Ref. 28-24-62)

R Fuel contents indicators (Ref. 28-44-83)

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OVERFLOW RELIEF VALVE SUP IND	1-213	Q721	K15
LH VENT VALVE SUP	1-213	Q722	K16
FQI CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17
R STBY 1 BOUNDARY	1-213	Q1367	L18

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
WARN SUP			
TANKS 9, 10, 11 FQI CH 'A' & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
STBY 1 CG LIMITS & CG COMPN SUP	2-213	Q1361	A24
STBY 1 MACH LIMITS COMPN SUP	2-213	Q1362	B23
TOTAL FUEL & MAIN CG COMPN SUP	2-213	Q1363	B24
RH VENT VALVE SUP	3-213	Q723	D7
STBY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C2
TANKS 9, 10, 11 FQI CHA 'B' & 3CM IND SUP	4-213	Q1356	B1
STBY 2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B2
TANKS 9, 10, 11 REFUEL FQI & FLIGHT COUNT SUP	13-215	Q1365	C17
REFUEL SHUT-OFF & VENT VALVES IND	15-215	Q511	E19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL CONT & FAIL IND	15-215	Q513	E20
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22
TANK 7 REFUEL VALVE SUP	15-215	Q517	F21
TANK 5 REFUEL VALVE SUP	15-215	Q518	E25
TANK 8 REFUEL VALVE SUP	15-215	Q519	F19
TANK 6 REFUEL VALVE SUP	15-215	Q520	F20
TANK 4 REFUEL VALVE SUP	15-215	Q521	E24
TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
FQI CONT PANEL WARN & FQI TEST SUP	15-215	Q1021	G25
STBY 2 MACH LIMITS COMPN SUP	13-216	Q1364	D3
TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
TANK 2 REFUEL VALVE SUP	15-216	Q524	F10
TANK 7A REFUEL VALVE SUP	15-216	Q525	F5
TANK 5A REFUEL VALVE SUP	15-216	Q526	F4
TANK 9 REFUEL VALVE SUP	15-216	Q515	F9
GRND POWER REFUEL	25-216	Q635	B8

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
CONT & IND			

(2) Gain access to the appropriate component as follows:-

(a) At the upper or lower fuel panel, release the quick-release fasteners, press in the spring retaining clip at each side of the panel and lower the panel on its hinges.

(b) At the refuel panel, open the refuel panel access door; support the panel, withdraw the Pip pins along the lower edge of the panel, and lower the panel on its hinges.

D. Remove Toggle Switch or Push-switch

(1) On a switch with screw-type terminals, roll back the rubber terminal cover and disconnect the electrical cables from the switch. On a switch with socket-type terminals, withdraw the pin inserts from the rear of the switch.

(2) Where necessary, unscrew the push-switch knob. Using a tubular spanner, remove the nut and washer from the front of the panel and remove the switch guard, if fitted. Withdraw the switch and tabwasher from the rear of the panel.

E. Install Toggle Switch or Push-switch

(1) Comply with the electrical safety precautions.

(2) Position the tabwasher on the switch and insert the switch through the aperture from the rear of the panel, ensuring that the tab on the tabwasher engages the locating hole in the panel.

(3) If applicable, refit the guard to the switch, and secure the switch with the nut and washer. Where necessary, refit the push-switch knob.

(4) Connect the electrical cables to the switch, ensuring that the connections are made in accordance with the cable identifications and the

applicable wiring diagram. Position the rubber terminal cover over the screw-type terminals.

F. Remove Rotary Switch

(1) Release the flying leads from the loom ties and withdraw the pin inserts from the module block.

(2) Remove the cap from the end of the switch knob, loosen the clutch nut and withdraw the knob from the switch spindle.

(3) Using a tubular spanner, remove the nut and washer from the front of the panel and withdraw the switch from the rear.

G. Install Rotary Switch

(1) Comply with the electrical safety precautions.

(2) Insert the switch through the aperture from the rear of the panel, ensuring that the locating spigot engages the locating hole in the panel.

(3) Secure the switch with the nut and washer.

(4) Fit the knob on the switch spindle, ensuring that the spindle spigot is engaged with the slot in the knob. Tighten the clutch nut and fit the end cap.

(5) Connect the flying leads to the module block, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

(6) Secure the flying leads to the cable loom with suitable ties in accordance with 20-27-15.

H. Remove Caption Light Module

(1) If necessary, release the cable loom ties to gain access to the terminals at the rear of the caption light module.

(2) Disconnect the electrical cables from the terminals. On modules with socket-type terminals, withdraw the pin inserts from the rear of the module.

(3) Disengage the clamp retaining springs at the rear of the module, and withdraw the module from the

front of the panel and the clamp from the rear.

J. Install Caption Light Module

(1) Comply with the electrical safety precautions.

(2) Position the clamp on the rear of the panel and insert the caption light module through the aperture from the front, ensuring that the hinged edge of the module is in alignment with the white-painted line on the back of the panel, and that the clamp is aligned symmetrically with the module.

(3) Hold the module firmly against the front of the panel and press the clamp into position from the rear until the retaining springs engage the recesses in module body.

(4) Connect the electrical cables to the module, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

(5) Secure the cable loom ties, as necessary, in accordance with 20-27-15.

K. Remove Magnetic Indicator

(1) If necessary, release the cable loom ties to gain access to the terminals at the rear of the magnetic indicator.

(2) Withdraw the pin inserts from the rear of the indicator.

(3) Remove the associated electroluminescent (EL) panel (Ref. 33-16-00) sufficiently to gain access to the magnetic indicator securing screws.

(4) Remove the securing screws from the front of the panel and withdraw the magnetic indicator from the rear.

L. Install Magnetic Indicator

(1) Comply with the electrical safety precautions.

(2) Assemble the magnetic indicator to the panel from the rear, ensuring that the word TOP on the body of the indicator is in alignment with the white-

painted line at the back of the panel.

(3) Secure the indicator to the panel with the securing screws, from the front.

(4) Refit the EL panel to its mounting (Ref. 33-16-00).

(5) Connect the electrical cables to indicator terminals, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

(6) Secure the cable loom ties, as necessary, in accordance with 20-27-15.

M. Remove Diode

(1) Remove the screws or the nuts, as applicable, securing the associated diode board cover to the diode board and remove the cover.

(2) Unsolder the diode wire ends from the barbs and remove the diode from the board.

N. Install Diode

(1) Comply with the electrical safety precautions.

(2) Position the replacement diode so that the black ring on the cathode end of the diode is pointing to terminal 2 on the diode board. Solder the wire ends to the associated barbs in accordance with the Wiring Diagram Manual, 20-42-23.

(3) Refit the diode board cover and secure it with the nuts or screws as applicable.

P. Conclusion

(1) Close the appropriate panel and secure it with the quick-release fasteners (upper or lower fuel panel) or with the Pip pins (refuel panel).

(2) Cancel the electrical safety precautions and check the operation of the component by carrying out the appropriate test procedure.

3. Fuel Relay Box Components (Ref. Fig. 403)

CAUTION: CERTAIN RELAYS WITHIN THE BOXES ARE PHYSICALLY

INTERCHANGEABLE BUT NOT ELECTRICALLY INTERCHANGEABLE. DURING RELAY REPLACEMENT ENSURE THAT THE CORRECT RELAY IS FITTED TO THE APPROPRIATE SOCKET.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 5.0 lbf in (0.056 mdaN)	-

B. Prepare

(1) Trip the associated circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH fuel relay box (15-123)			
LH VENT VALVE SUP	1-213	Q722	K16
TANK 11 GRN PUMP CONT	1-213	1Q185	J18
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15
ENG 1 LP VALVE SUP 2	16-215	1Q2	-
ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
TANK 1 JET VALVE SUP	3-213	Q131	C7
LH JET MASTER VALVE SUP & IND	3-213	1Q302	A7
TANK 9 LH INLET VALVE O/RIDE SUP	3-213	Q367	E5
TANK 5 INLET VALVE O/RIDE SUP	3-213	Q369	E6

R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH INLET VALVE O/RIDE SUP	3-213	Q371	E7
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 LH PUMP SUP	14-215	1Q189	C17
TANK 2 MAIN PUMP IND	15-215	2Q831	B19
TANK 2 STBY 1 PUMP IND	15-215	2Q832	B20
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
TANK 9 LH & 10 RH PUMPS IND	15-215	Q182	D21
TANK 9 LH INLET VALVE MAIN SUP	15-215	Q361	G19
TANK 5 INLET VALVE MAIN SUP	15-215	Q363	G20
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q365	G21
REFUEL SHUT OFF & VENT VALVE IND	15-215	Q511	E19
REFUEL CONT & FAIL IND	15-215	Q513	E20
TANK 6 REFUEL VALVE SUP	15-215	Q520	F20
TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
TANK 5 REFUEL VALVE SUP	15-215	Q518	E25
ENG 1 ACCUM IND & BY-PASS VALVE CONT	15-215	1Q761	F22
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH PUMP IND	15-215	Q1388	E21
TANK 5A PUMPS IND	15-215	Q891	C23
TANK 5A-5 TRANS VALVE SUP & IND	15-215	Q6668	G24
TRIM TRANS AUTO SUP	13-216	Q374	E4
TANK 11 LH PUMP SUP	13-216	Q1375	F4
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 LH PUMP SUP	14-216	1Q190	B1
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
TANK 1 MAIN PUMP IND	15-216	1Q831	B1
TANK 1 STBY 1 PUMP IND	15-216	1Q832	B2
ENG 2 ACCUM IND & BY-PASS VALVE CONT	15-216	2Q761	E3
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 2 LP VALVE POS IND	15-216	2Q3	C3
TANK 2 JET VALVE SUP	15-216	Q132	B7
TANK 9 RH & 10 LH PUMPS IND	15-216	Q183	D1
TANK 11 LH PUMP CONT	15-216	Q187	D3
TANK 11 GRN PUMP IND	15-216	1Q186	D2
TRIM TRANS AUTO CONT	15-216	Q373	D7
TANK 2 REFUEL VALVE SUP	15-216	Q524	F10
TANK 5A REFUEL VALVE	15-216	Q526	F4

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP			
TANK 7A-7 TRANS VALVE SUP & IND	15-216	Q6669	F7

**ON A/C ALL

RH fuel relay box (18-123)

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 4 LP VALVE SUP 2	16-215	4Q2	-
TANK 3 JET VALVE SUP	1-213	Q133	L11
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K18
TANK 9 RH INLET VALVE O/RIDE SUP	1-213	Q368	J13
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
TANK 11 BLUE PUMP CONTROL	3-213	2Q185	F5
RH VENT VALVE SUP	3-213	Q723	D7
TANK 10 RH PUMP CONT	13-215	2Q184	B16
TANK 10 RH PUMP SUP	13-215	2Q190	C19
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20
ENG 4 LP VALVE POS IND	15-215	4Q3	C22
TANK 4 JET VALVE SUP	15-215	Q134	D20
TANK 11 BLUE PUMP IND	15-215	2Q186	D22
TANK 11 RH PUMP CONT	15-215	Q188	D23
REFUEL SHUT-OFF &	15-215	Q511	E19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
VENT VALVES IND			
REFUEL CONT & FAIL IND	15-215	Q513	E20
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22
TANK 7 REFUEL VALVE SUP	15-215	Q517	F21
TANK 8 REFUEL VALVE SUP	15-215	Q519	F19
TANK 4 REFUEL VALVE SUP	15-215	Q521	E24
ENG 3 ACCUM IND & BY-PASS VALVE CONT	15-215	3Q761	F23
ENG 3 BY-PASS VALVE SUP & IND	15-215	3Q762	F25
TANK 5A-5 TRANS VALVE SUP & IND	15-215	Q6668	G24
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 9 RH PUMP SUP	13-216	2Q189	B1
TRIM TRANS AUTO SUP	13-216	Q374	E4
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
ENG 3 LP VALVE POSN IND	15-216	3Q3	C4
R TANK 9 RH & 10 LH PUMPS IND	15-216	Q183	D1
TANK 9 RH INLET VALVE MAIN SUP	15-216	Q362	D4
TANK 7 INLET VALVE MAIN SUP	15-216	Q364	D5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 RH INLET VALVE MAIN SUP	15-216	Q366	D6
TRIM TRANS AUTO CONT	15-216	Q373	D7
TANK 9 REFUEL VALVE SUP	15-216	Q515	F9
TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
TANK 7A REFUEL VALVE SUP	15-216	Q525	F5
ENG 4 ACCUM IND & BY-PASS VALVE CONT	15-216	4Q761	E4
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6
R TANK 3 MAIN PUMP IND	15-216	3Q831	B4
R TANK 3 STBY 1 PUMP IND	15-216	3Q832	B5
TANK 7A-7 TRANS VALVE SUP & IND	15-216	Q6669	F7
TANKS 1-4 AFT TRIM CONT & IND	15-216	Q2101	C7
TANK 7A PUMPS IND	15-216	Q892	A7
GRND POWER REFUEL	25-216	Q635	B8

(2) Open service compartment door 123 BB (Ref. 52-41-11) to gain access to the left or right fuel relay box, 15-123 or 18-123, respectively, mounted in the forward underfloor racking.

(3) Release the hold-down fasteners from the appropriate fuel relay box hold-down hooks.

(4) Withdraw the panel from the rack sufficiently to gain access to the quick-release cable clamps on top of the box.

(5) Release the cable clamps to detach the cables from the top of the box.

(6) Withdraw the box clear of the rack and lower it on to a suitable support.

C. Remove Relay

(1) Remove the nuts and washers or the spring clamp, as applicable, securing the relay to its mounting base, and withdraw the relay from the socket.

D. Install Relay

(1) Comply with the electrical safety precautions.

(2) Check that the mounting lugs of 'half crystal can size' relays are at 90 deg to the relay body. Re-align the lugs as necessary.

(3) Align the locating pin on the relay body with the locating hole in the relay mounting base and plug the relay into the socket.

(4) Secure the relay body to the socket with the nuts and washers, or the spring clamp, as applicable.

E. Remove Diode

(1) Remove the screws securing the diode board cover to the distance pillars and remove the cover from the diode board.

(2) Disconnect the diode from the mounting studs and remove the diode from the board.

F. Install Diode

(1) Comply with the electrical safety precautions.

<u>NOTE</u>: If the replacement diode does not have tags fitted to wire ends, the terminal tags must be crimped to the ends in accordance with the Wiring Diagram Manual, 20-42-01. Tags for diodes are,

pin 1, Solidstrand AMP 34105, and pin 2, Solidstrand 34104-T006-02.

(2) Position the replacement diode so that the black ring on the cathode end of the diode is pointing to terminal 2 on the diode board. Secure the tags to the mounting studs with the nuts and washers. On size 6 stud, torque-tighten the terminal nut to 5.0 lbf in (0.056 mdaN).

(3) Refit the diode board cover to the distance pillars and secure it with the screws.

G. Conclusion

(1) Mount the relay box on the end of the rack support rails and secure the cables to the top of the panel with the quick-release cable clamps.

(2) Slide the box into the racking and secure it with the hold-down fasteners.

(3) Check that the relay box is bonded in accordance with 20-27-11.

(4) Cancel the electrical safety precautions and check the operation of the component by carrying out the appropriate test procedure.

(5) Close and secure service compartment door 123 BB (Ref. 52-41-11).

4. Fuel Contactor Box Components (Ref. Fig. 404)

CAUTION: CERTAIN RELAYS WITHIN THE BOXES ARE PHYSICALLY INTERCHANGEABLE BUT NOT ELECTRICALLY INTERCHANGEABLE. DURING RELAY REPLACEMENT ENSURE THAT THE CORRECT RELAY IS FITTED TO THE APPROPRIATE SOCKET.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 4.0 to 5.0 lbf in (0.045 to 0.056 mdaN)	-

DESCRIPTION	PART NO.

B. Prepare

(1) Trip the associated circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH fuel contactor box (22-123)			
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 1 STBY 1 PUMP SUP	4=213	1Q835	F5
TANK 2 STBY 1 PUMP SUP	4-213	2Q835	B5
TANK 5-1 PUMP SUP	4-213	Q905	D5
TANK 5-2 PUMP SUP	13-215	Q906	E19
TANK 5A INNER PUMP SUP	13-215	Q902	A19
TANK 11 RH PUMP SUP	13-215	Q1376	E16
TANK 11 RH PUMP CONT	15-215	Q188	D23
TANK 5A OUTER PUMP SUP	14-215	Q901	E14
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 LH PUMP SUP	14-215	1Q189	C17

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 STBY 2 PUMP SUP	13-216	1Q836	D1
TANK 2 STBY 2 PUMP SUP	14-216	2Q836	F4
TANK 6-2 PUMP SUP	13-216	Q912	F1
TANK 10 LH PUMP SUP	14-216	1Q190	B1
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 DE-AIR PUMP SUP	14-216	Q6666	F7
TANK 8-4 PUMP SUP	14-216	Q909	D1
RH fuel contactor box (24-123)			
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
TANK 3 STBY 1 PUMP SUP	4-213	3Q835	A8
TANK 4 STBY 1 PUMP SUP	4-213	4Q835	F8
TANK 7-3 PUMP SUP	4-213	Q908	C8
TANK 4 STBY 2 PUMP SUP	13-215	4Q836	G16
TANK 8-3 PUMP SUP	13-215	Q910	G19
TANK 10 RH PUMP CONT	13-215	2Q184	B16
R TANK 10 RH PUMP SUP	13-215	2Q190	C19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 3 STBY 2 PUMP SUP	14-215	3Q836	G14
TANK 6-1 PUMP SUP	14-215	Q911	G17
TANK 7-4 PUMP SUP	14-215	Q907	E17
TANK 7A INNER PUMP SUP	13-216	Q903	C4
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 9 RH PUMP SUP	13-216	2Q189	B1
TANK 11 LH PUMP SUP	13-216	Q1375	F4
TANK 7A OUTER PUMP SUP	14-216	Q904	D4
SCAVENGE PUMP SUP	14-216	Q491	E4
TANK 11 LH PUMP CONT	15-216	Q187	D3

(2) Open service compartment door 123 BB (Ref. 52-41-11) to gain access to the left or right fuel contactor box, 22-123 or 24-123, respectively, mounted in the forward underfloor racking.

(3) For the LH fuel contactor box, release the cable assembly by removing the appropriate cable clamp and cable clips. For the RH fuel contactor box, release the cable assembly from the cable stowage under the racking.

(4) Release the hold-down fasteners from the appropriate contactor box hold-down hooks.

(5) Withdraw the box from the rack and lower it on to a suitable support.

(6) Release the contactor box side cover quick-release

fasteners and remove the cover from the side of the box.

C. Remove Relay

(1) Remove the nuts and washers securing the relay to its mounting base and withdraw the relay from the socket.

D. Install Relay

(1) Comply with the electrical safety precautions.

(2) Align the locating pin on the relay body with the locating hole in the relay mounting base and plug the relay into the socket.

(3) Secure the relay body to the socket with the nuts and washers.

E. Remove Contactor

(1) Remove the contactor terminal cover.

(2) Disconnect the electrical cables from the terminals.

(3) Remove the bolts securing the contactor to the chassis and remove the contactor from the box.

(4) Refit the terminal cover to the contactor.

F. Install Contactor

(1) Comply with the electrical safety precautions.

(2) Remove the contactor terminal cover.

(3) Mount the contactor on the chassis and secure it with the bolts.

(4) Connect the electrical cables to the terminals, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram. Torque-tighten the terminal screws to between 4.0 and 5.0 lbf in (0.045 and 0.056 mdaN).

(5) Refit the terminal cover to the contactor.

(6) Check that the contactor is bonded in accordance with 20-27-11.

(7) Refit the cover to the side of the box and secure it with the quick-release fasteners.

G. Conclusion

(1) Mount the contactor box on the rack support rails and slide the box into its housing in the racking.

(2) Secure the box with the hold-down fasteners.

(3) Secure the cable assembly with the cable clamp and clips, or secure the cable assembly in the cable stowage under the racking, as applicable.

(4) Check that the contactor box is bonded in accordance with 20-27-11.

(5) Cancel the electrical safety precautions and check the operation of the component by carrying out the appropriate test procedure.

(6) Close and secure service compartment door 123 BB (Ref. 52-41-11).

5. Bypass Valve (MMEL Procedure)

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

A. General

The bypass valve in each of the four engine feed systems is located in the wing dry bay above the appropriate nacelle.

This procedure is for use following failure of a bypass valve. It ensures that the valve is able to meet the minimum requirement for normal flight, i.e., that the valve plate will function satisfactorily in the spring-loaded mode.

The procedure entails removal of the gearbox and motor assembly, to enable the valve-plate operation to be checked. After completion of the check, subsequent action is determined by the valve condition at the time of failure; if the valve was closed, the complete gearbox and motor assembly is reinstalled; if the valve was open, only the gearbox is reinstalled.

B. Equipment and Materials

DESCRIPTION	PART NO.
Key, for access panel	E920132000
Circuit breaker safety clips	-
Continuity meter (e.g., Multimeter)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Grease, anti-fretting (Ref. 20-30-00, No.54)	-
Test lever (Flight Refuelling) (or suitable alternative)	2249005
Clean, lint-free cloth	-

C. Prepare to Remove Gearbox and Motor

(1) Ensure that the FUEL L.P. PROTECTION switch on the fuel management panel is at the OFF position.

(2) Electrically isolate the appropriate bypass valve motor by tripping the associated circuit breaker; fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
ENG 3 BY-PASS VALVE SUP & IND	15-216	3Q762	F25
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6

(3) Using the key, unlock and remove the appropriate access panel (531 AT, 532 AT, 631 AT or 632 AT) located on the top surface of the wings.

(4) If required for access, remove the fire extinguisher bottles (Ref. 26-21-11).

(5) Place clean, lint-free cloth beneath the bypass valve to collect any residual fuel.

D. Remove Gearbox and Motor (Ref. 28-21-41, Fig.401)

(1) Disconnect the electrical connector from the motor.

NOTE: Operations (2) and (3) are alternatives, depending upon the position of the valve when failure occurred.

(2) If the valve has failed in the 'closed' position, unscrew the four captive bolts securing the gearbox/ motor assembly and remove it from the bypass valve body. Remove the cover plate from the gearbox.

(3) If the valve has failed in any position other than closed, proceed as follows:-

CAUTION: THE NEARER THE VALVE IS TO THE FULLY OPEN POSITION THE GREATER IS THE TORSIONAL (TWISTING) LOAD ON THE SPLINES OF THE GEARBOX/VALVE PLATE SHAFT. THEREFORE, REMOVING THE GEARBOX WITHOUT FIRST NULLIFYING THE LOAD MAY RESULT IN DAMAGE TO THE SPLINES.

(a) Unscrew the captive bolts securing the gearbox/ motor assembly to the bypass valve body.

NOTE: In the following operations, 'clockwise' and 'counter-clockwise' are the direction of rotation as viewed on the cover-plate end of the gearbox.

(b) Rotate the assembly as far as possible in the following direction, as appropriate:-

b1) Engine 1 or 2: counter-clockwise.

b2) Engine 3 or 4: clockwise.

(c) Remove the cover plate.

(d) At the cover plate end of the gearbox, insert the test lever into the gearbox splines; turn the test lever progressively, in increments of approximately 1 deg, (clockwise for engine 1 or 2; counter-clockwise for engine 3 or 4), and simultaneously apply a withdrawal force on the gearbox. When the torsional load has been nullifed, indicated by the splines sliding freely, remove the gearbox.

(e) Release the spring tension slowly.

(f) Remove the four nuts securing the motor to the gearbox; remove the motor.

E. Check Before Installation

(1) Manually turn the valve plate shaft and check that the shaft moves freely over its full operating range.

(2) At the cover plate end of the gearbox, manually turn the shaft in the gearbox (clockwise for engine 1 or 2; counter-clockwise for engine 3 or 4); check that spring tension is evident.

(3) If the gearbox/motor assembly is to be refitted, check that the motor is at the 'closed' position by connecting a continuity meter between pins B and D of the electrical connector on the motor; check that continuity is evident. Remove the meter.

F. Install Gearbox and/or Motor

B NOTE: (1) Valve P/N 9402021 (Long Actuator) cannot be
B fitted at No.1 location on A/C G-BOAB and
B G-BOAC due to the proximity of Hydraulic
B Pipes at this location. Install valve
B P/N 9402018.

B (2) Operations (1) and (2) are alternatives.

(1) If the gearbox only is being installed, carry out the following:-

(a) At the cover plate end of the gearbox, turn the shaft in the gearbox (clockwise for engine 1 or 2; counter-clockwise for engine 3 or 4) until the spring tension is evident and then slowly release the spring tension. Ensure that the shaft remains in this position up to and including assembly to the valve plate shaft.

(b) Apply anti-fretting grease to the splines on the valve plate shaft.

(c) Fit new O-ring seals, lubricated in accordance with 20-23-11.

(d) For engine 3 or 4, refit the cover plate to the gearbox.

(e) With the gearbox held end-plate upward, pour clean fuel, via the holes in the end-plate, into the gearbox. During this operation, gently tilt and oscillate the gearbox to prevent airlocks and to ensure complete filling.

(f) For engine 1 or 2, refit the cover plate to the gearbox.

(2) If the gearbox/motor assembly is being installed, carry out operations (1)(b), (c), (d), (e) and (f).

(3) With the valve plate and the gearbox, or gearbox/motor assembly, as applicable, in the 'closed' positions, fit the gearbox shaft to the valve plate shaft; fully engage the splines by easing the gearbox into close contact with the valve body.

(4) Turn the gearbox so that the bolt-holes are aligned and the tension spring is tensioned to hold the valve plate in the closed position.

(5) Secure the gearbox with the four captive bolts; torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

NOTE: Operations (6) and (7) are alternatives.

(6) If the gearbox/motor assembly has been installed, connect the electrical connector to the motor, ensuring that the mating surfaces are clean and undamaged.

(7) If the gearbox only has been installed, place the electrical connector in a clean plastic bag and securely tie it in any suitable position.

G. Conclusion

(1) Remove the cloth used for collecting residual fuel; thoroughly clean and dry the bay.

(2) If applicable, refit the fire extinguisher bottles (Ref. 26-21-11).

(3) Refit the access panel and lock it, using the key.

(4) Ensure that the circuit breaker tripped in operation C.(2) is still tripped and securely safety-clipped. Ensure (by displaying a placard if possible) that the circuit breaker is not subsequently reset.

H. Reactivation of Bypass Valve

(1) Refer to 28-21-00, Trouble Shooting; trace and rectify the fault.

6. Refuel Valve (MMEL Procedure) (Ref. Fig. 407)

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

CAUTION: THE FOLLOWING PROCEDURE MUST NOT BE USED FOR TANK 11 TRIM/REFUEL VALVE.

A. General

If a single refuel valve fails to close, and it is not practicable to eliminate the fault that caused the failure, this procedure will enable a flight to proceed in accordance with the Manufacturer's Minimum Equipment List.

The procedure, which ensures that the valve is made electrically safe and is mechanically locked in the closed position, entails removing the motor, complete with gearbox, and then manually closing and locking the valve closed with a special tool (locking cap).

B. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Locking cap (Flight Refuelling)	7903622
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

DESCRIPTION	PART NO.

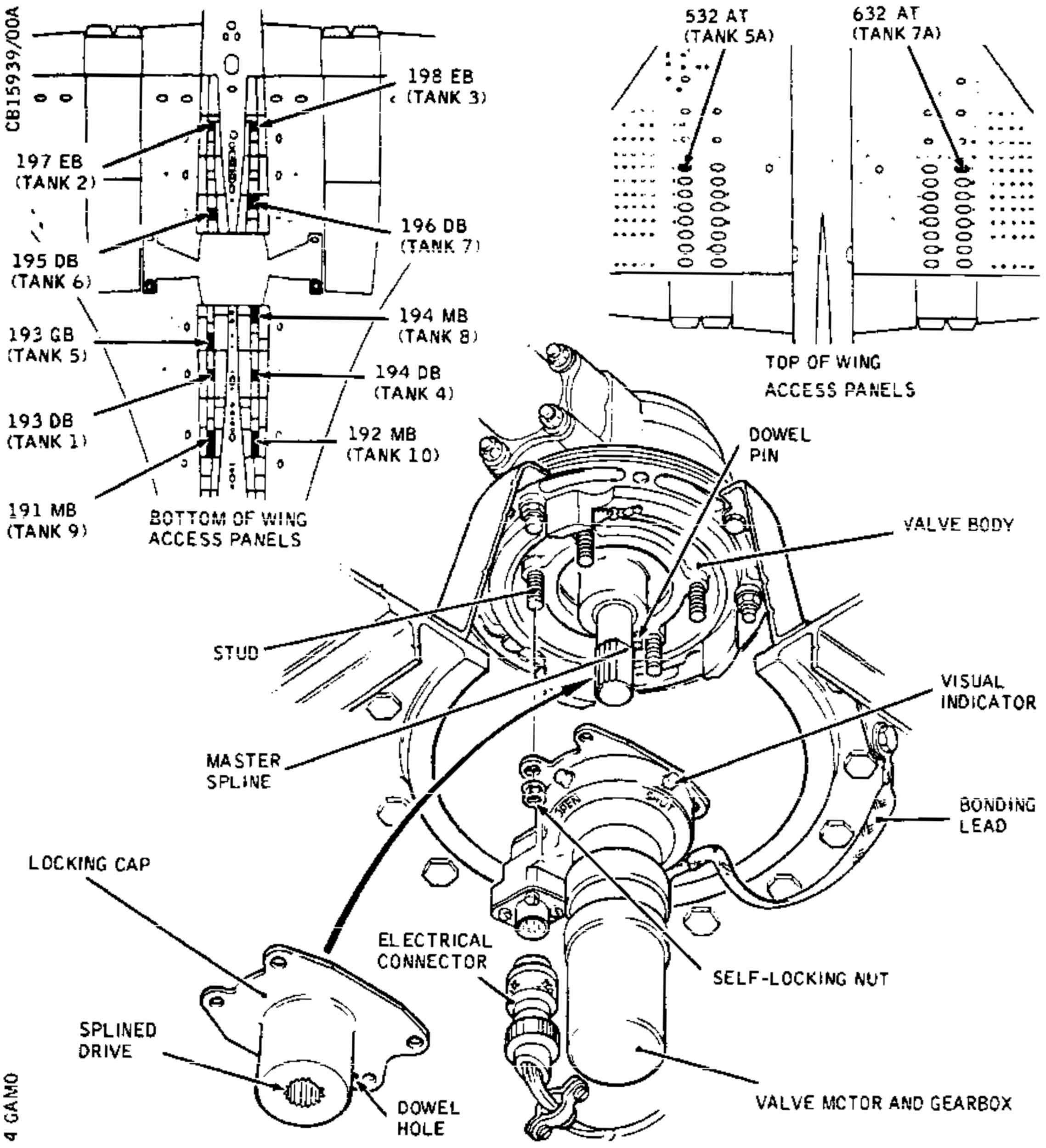
C. Prepare

(1) If required, transfer fuel (Ref. 28-00-00, Servicing) out of the overfull tank until the TANK O/F caption, at the refuel control panel, is extinguished.

(2) Electrically isolate the refuel valve by tripping the appropriate circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL VALVE SUP			
TANK 1	15-215	Q522	E23
TANK 2	15-216	Q524	F10
TANK 3	15-216	Q523	F3
TANK 4	15-215	Q521	E24
TANK 5	15-215	Q518	E25
TANK 6	15-215	Q520	F20
TANK 7	15-215	Q517	F21
TANK 8	15-215	Q519	F19
TANK 9	15-216	Q515	F9
TANK 10	15-215	Q516	E22
TANK 5A	15-216	Q526	F4
TANK 7A	15-216	Q525	F5

(3) Remove the appropriate access panel (Ref. Fig. 407).



TANK NO.	1	2	3	4	5	5A	6	7	7A	8	9	10
ELECT. IDENT.	Q625	Q627	Q626	Q624	Q621	Q629	Q623	Q620	Q628	Q622	Q618	Q619
ELECTRICAL IDENT. AND ASSOCIATED TANK NOS.												

Refuel Valve and Locking Cap
Figure 407

D. Close and Lock Valve

(1) Disconnect the electrical connector from the valve.

(2) Suitably blank the free connector and stow it securely.

(3) Support the motor and gearbox. Remove the self-locking nuts securing the bonding lead and the motor and gearbox to the studs on the valve body.

(4) Remove the valve motor and gearbox from the valve body.

(5) Using the locking cap, rotate the splined drive, in the valve body, 90 deg clockwise.

(6) Ensure that the master splines on the locking cap and splined drive are in alignment and that the dowel hole in the locking cap is located over the dowel pin in the valve body.

(7) Fit the locking cap over the studs on the valve body.

(8) Attach the bonding lead to the appropriate stud.

(9) Secure the locking cap and bonding lead to the valve body with the self-locking nuts. Torque-tighten the nuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

E. Conclusion

(1) Refit the access panel previously removed.

(2) Ensure that the circuit breaker remains tripped.

(3) If the failed valve was in tank 1, 2, 3, 4, 5, 6, 7, 8 or 10, place a placard on the associated standby inlet valve switch on the fuel management panel (3CM station) to indicate that the valve is inoperative and locked closed.

F. Reactivation of Refuel Valve

(1) Refer to 28-24-00, Trouble Shooting; trace and rectify the fault.

(2) If applicable, remove the placard from the fuel management panel (3CM station).

END OF THIS SECTION

NEXT

STORAGE - SERVICING

WARNING: OBSERVE THE GENERAL SAFETY PRECAUTIONS IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

R OBSERVE THE AIRCRAFT GROUND STABILITY PROCEDURES
R DETAILED IN 12-00-10.

1. General

When fuel tank access panels are removed or when entry into
R a fuel tank is required, the precautions in paragraphs 2., 3., 4. and 5. must be observed. These precautions must be read in conjunction with any special notes and precautions which may apply to specific maintenance operations.

2. Safety Precautions

(1) Personnel working in or around the fuel tanks must wear
R clean, explosion-proof protective clothing (Ref. 28-00-00).

(2) Breathing apparatus must be worn by any operator working in the tank and any operator working in an area of high fume concentration, e.g., the safety attendant outside the tank, subject to the following conditions:

(a) If the atmosphere inside the tank is below 5 per
R cent of the lower explosive limit (L.E.L.), as indicated by a combustible gas indicator (Ref. para. 8.), breathing apparatus need not be worn provided that there is a continuous circulation of fresh air through the tank at all times while the operator is inside, and any fumes in the tank created by sealants etc. can be blown away from the operator's face.

(b) If the atmosphere inside the tank is between 5 per cent and 25 per cent L.E.L., breathing apparatus must be worn at all times.

(c) Standby equipment must be available to all operators at all times.

(3) The safety attendant must be in visual contact with, and responsible for the safety of, the operator inside the tank.

NOTE: This may necessitate the attendant putting his head through an appropriate manhole to gain an unobstructed view of the operator inside the tank.

(4) Persons breathing high concentrations of fuel vapour will experience severe headaches, a general feeling of sleepiness, or fainting. Persons suffering from slight headaches, irritation of the eyes or exposed areas of skin, or any other symptoms of over-exposure, must move to fresh air immediately, and subsequently report to the nearest medical centre.

<u>WARNING</u>: DO NOT REMOVE RESPIRATOR WHILE INSIDE A TANK. SEVERE ILLNESS, UNCONSCIOUSNESS OR DEATH CAN RESULT FROM EXCESSIVE EXPOSURE TO FUEL VAPOUR.

(5) In the event of either operator being overcome by fumes the following procedure must be observed:

R (a) If the operator in the tank becomes unwell, he must
be given a plentiful supply of fresh air either by
R directing the ventilating air toward his face or
by placing a respirator mask over his face. In
the event of non-recovery within 5 min he must
leave the tank immediately.

R (b) If the operator becomes unconscious, the
attendant must summon assistance and remove the
operator from the tank immediately.

R (c) If the safety attendant becomes unwell he
must summon a replacement immediately. Under no
circumstances must the operator in the tank be left
unattended. If no replacement is available the
operator must leave the tank until such time as a
replacement arrives.

(d) If, when the operator has been removed from the
aircraft it is found that his breathing has slowed
or stopped, artificial respiration must be applied
immediately by a qualified person, e.g., the attend-
R ing fireman, and medical assistance sent for.
R The artifical respiration must not be stopped
R under any circumstances.

R (6) If fuel is splashed into the eyes, they must be
R flushed with water for at least 15 min, the upper
R and lower eyelids being lifted frequently to ensure
R thorough washing. The affected person must then
R report to the nearest medical centre.

(7) All equipment used in the tank must be scrupulously clean and free from dirt, grit, swarf, oil contamination, flaking paint or any other material that may be deposited in the tank.

(8) Ventilating air from the compressor must be filtered to remove all impurities, particularly oil and water.

RB (9) Only Eurotwill cloth is approved for drying tank interiors.

(10) Extreme care must be taken to avoid inadvertent damage to the internal structure or sealant during maintenance. Internal fuel pipes are particularly susceptible to damage and should be removed where access is restricted. Damage to electrical cables and conduits must be avoided.

NOTE: For removal/installation of pipes reference must be made to the appropriate system maintenance section.

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(11) Access mats must be used on the floor of the tank to prevent damage to the tank structure and as a safeguard against injury to the operator should he be overcome by fumes.

3. Fuel Tank Working Areas (Ref. Fig. 301)

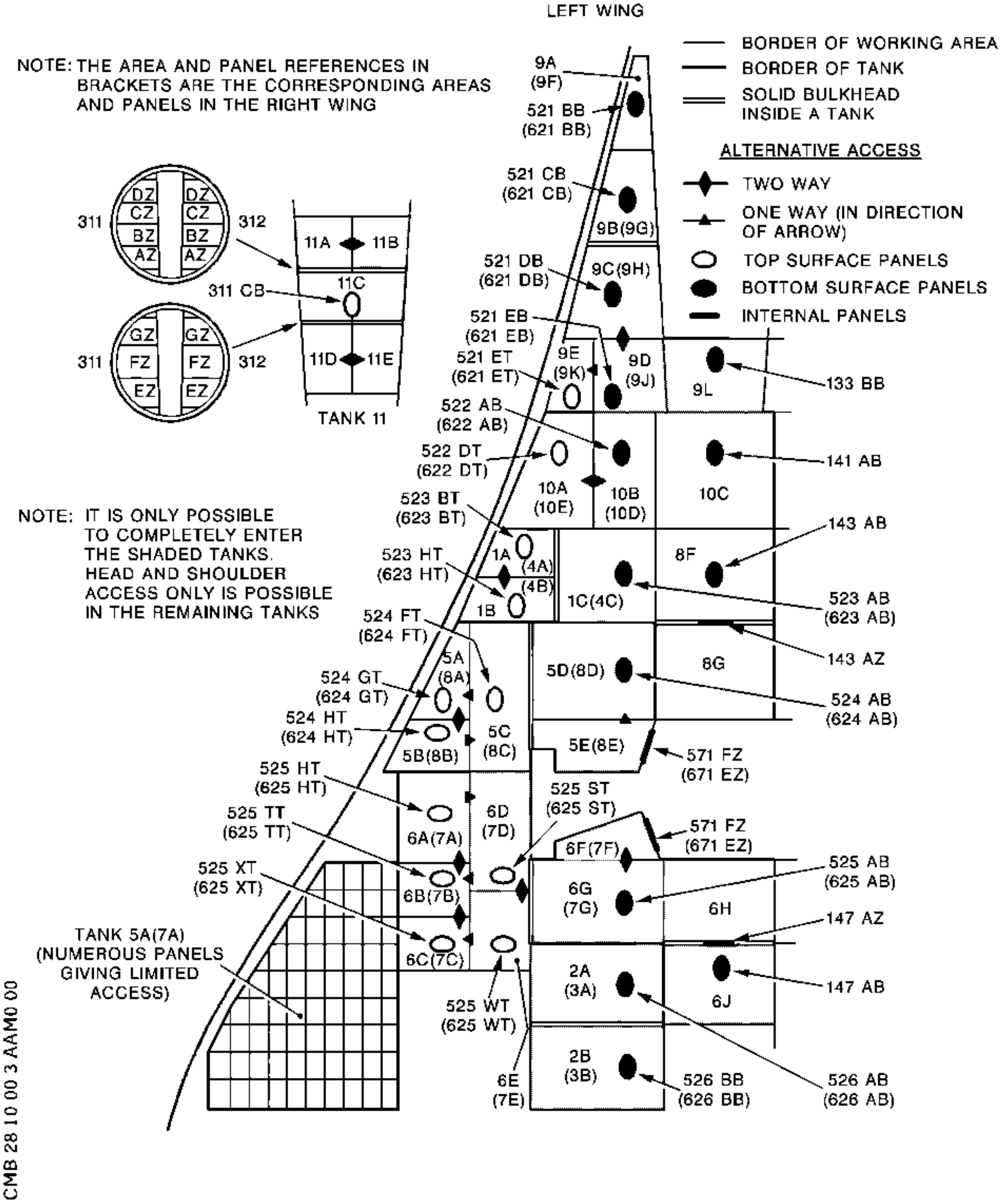
Each fuel tank is divided into working areas, each area having its own access panel or panels. It is possible in some cases to gain entry to a working area from an adjacent area, but this must be done only if the operator in the tank is unwell. Some tanks, however, have only one working area, or the working areas are divided by a fixed baffle plate or tank wall, which means that there is no alternative access to that area.

WARNING: EXERCISE EXTREME CAUTION WHEN WORKING IN THESE AREAS.

Before entering a tank, the working area diagram must be studied to establish which area is to be worked in and the extent of the area. To carry out maintenance in some of the outer wing areas it may be possible to make only a partial entry of the tank.

WARNING: WHEN ONLY PARTIAL ENTRY OF THE TANK IS POSSIBLE THE FULL SAFETY PRECAUTIONS WILL STILL APPLY.

An operator must be acquainted with the structure of the tanks, access panels and component location and thereby know the tools and equipment required for a particular operation. To gain access to more remote corners of a working area it may be necessary to remove parts of the structure, pipes and equipment. Before this is done reference must be made to the relevant maintenance section.



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Fuel Tank Working Areas
Figure 301

The working area diagram illustrates the borders of tanks, borders of working areas, access panels and alternative access.

WARNING: THE ALTERNATIVE ACCESS REFERENCES ARE ONLY FOR USE IN AN EMERGENCY. DO NOT USE THESE ACCESSES FOR NORMAL MAINTENANCE.

The wing tip tanks, 5A and 7A, are too shallow to allow an operator to enter them. The tank interior is only accessible through 75 small access panels in the wing top surface. These give 75 working areas, each about 2 square feet and having its own access panel. Maintenance must, therefore, be carried out from outside the tank.

R In a tank divided by a bulkhead incorporating a removable
R access panel (i.e., the fuselage cells of tanks 6, 8 and 11), it will be necessary, when the operator is working behind the bulkhead, for the attendant to insert at least his head and shoulders into the tank to observe the operator working therein.

4. Fuel Tank Access (Ref. Fig.302 and 303)

Each fuel tank is a self-contained unit and access to any part of a particular tank is by the access panels in that tank. It is not possible to gain access to a tank from an adjacent tank, neither is it possible, where a tank is divided into cells, i.e., a wing cell and a fuselage cell, to gain access from one cell to the other. Details of working areas in individual tanks are in paragraph 3.

5. Entering a Fuel Tank (Ref. Fig. 304)

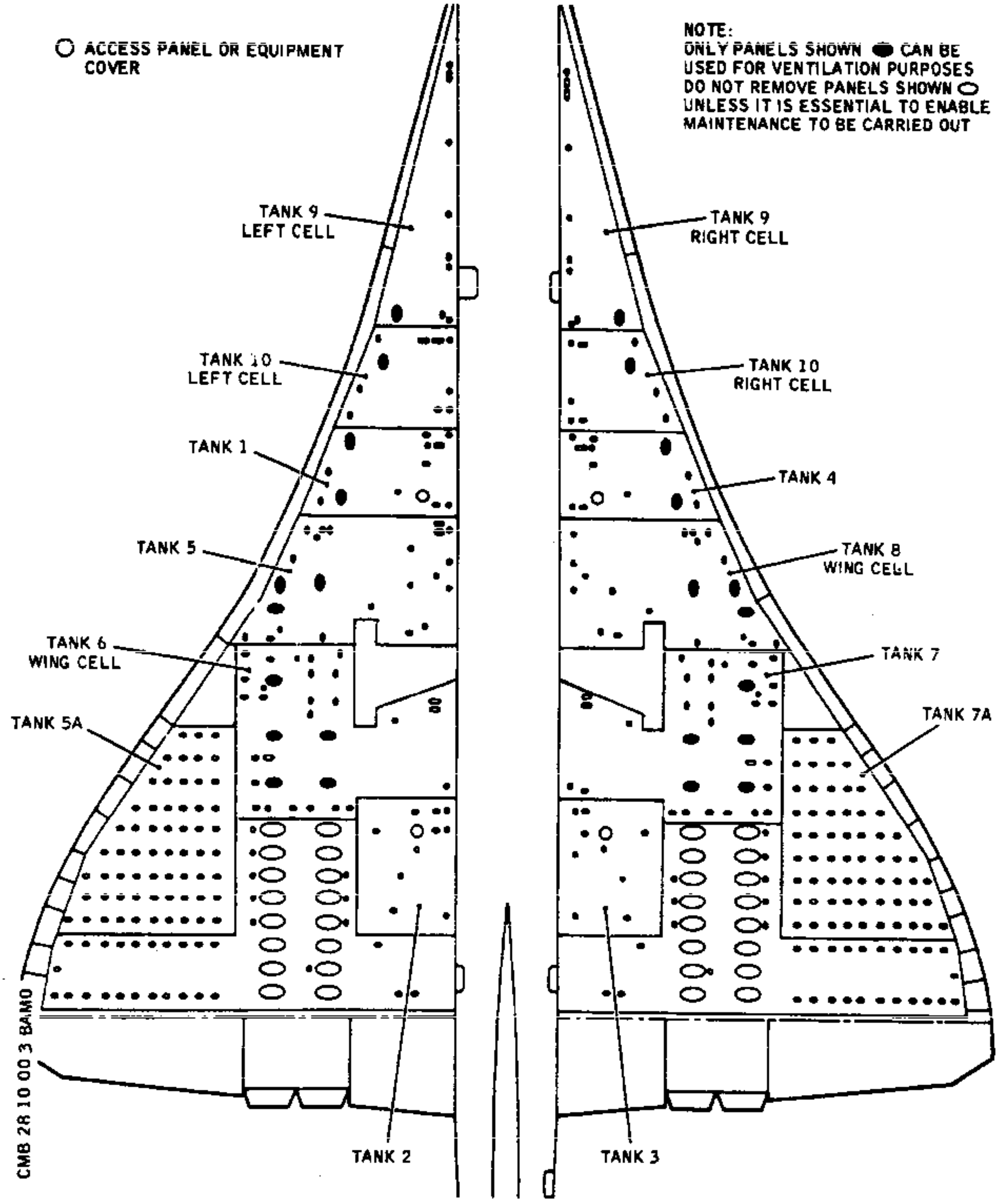
WARNING: OBSERVE THE SAFETY PRECAUTIONS DETAILED IN 28-00-00.

TO PREVENT INADVERTENT DISCHARGE OF FUEL INTO A TANK, THE ASSOCIATED PUMPS AND VALVES CONTROL CIRCUIT BREAKERS MUST BE TRIPPED.

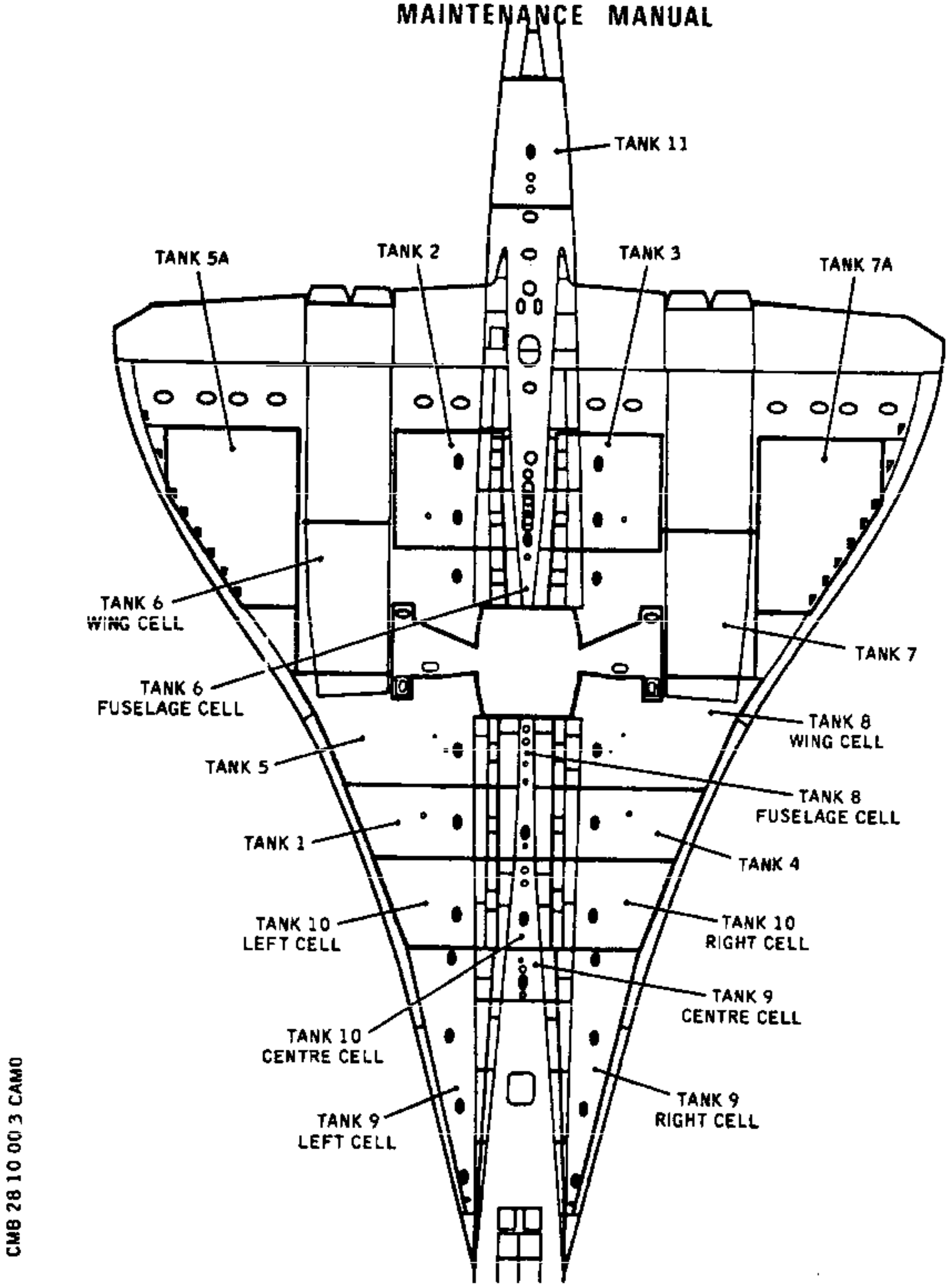
R A. Preparation - Aircraft

(1) Rope off an area around the aircraft approximately 220 x 100 ft (67.05 x 30.48 m) overall.

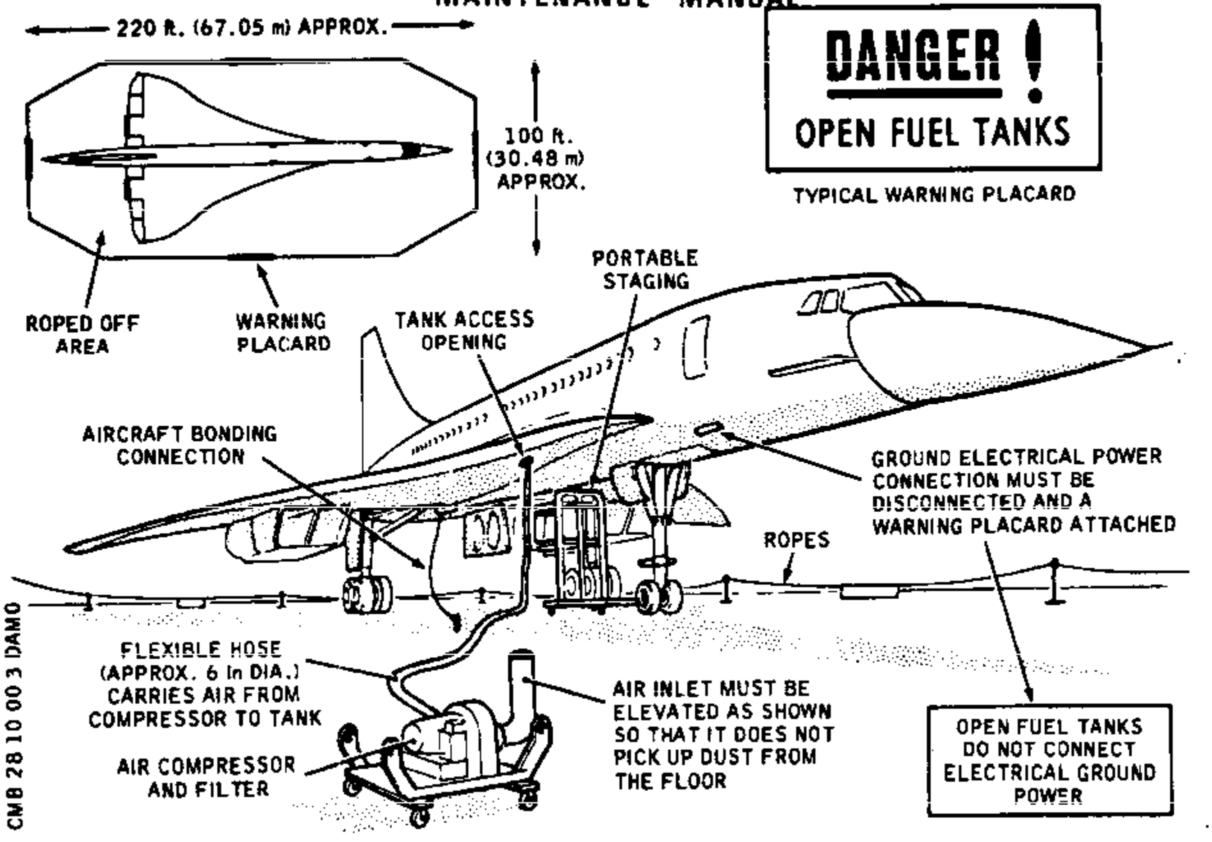
R (2) Placard the area to warn that fuel system
R maintenance is in progress and that smoking is
R forbidden. Display any other notices considered
R necessary for safety.



Access Panels - Top Surface
Figure 302



Access Panels - Bottom Surface
Figure 303



\- Typical Layout of Maintenance Area
Figure 304

(3) Position portable staging as necessary.

R (4) Ensure that the aircraft is electrically earthed and that electrical bonding is established for all staging and associated equipment, before maintenance commences.

(5) Defuel the tank (Ref. 28-25-00, Servicing).

(6) Ensure that all isolation valves associated with the defuelled tanks are closed.

(7) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 9 RH INLET	1-213	Q368	J13

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
VALVE O/RIDE SUP			
TANK 7 INLET VALVE O/RIDE SUP	1-213	Q370	J14
TANK 11 RH INLET VALVE O/RIDE SUP	1-213	Q372	J15
TANK 11 GRN PUMP CONT	1-213	1Q185	J18
ENG 2 CROSSFEED VALVE SUP & IND	1-213	2Q41	K11
ENG 3 CROSSFEED VALVE SUP & IND	1-213	3Q41	K12
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 3 JET VALVE SUP	1-213	Q133	L11
TANK 6-7 INTERCON SUP & IND	1-213	Q872	L12
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
ENG 1 CROSSFEED VALVE SUP & IND	3-213	1Q41	B5
ENG 4 CROSSFEED VALVE SUP & IND	3-213	4Q41	B6
TANK 5-8 INTER-CON VALVE SUP & IND	3-213	Q871	B7
TANK 1 JET VALVE SUP	3-213	Q131	C7
TANK 9 LH INLET VALVE O/RIDE SUP	3-213	Q367	E5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5 INLET VALVE O/RIDE SUP	3-213	Q369	E6
TANK 11 INLET VALVE O/RIDE SUP	3-213	Q371	E7
TANK 11 BLUE PUMP CONT	3-213	2Q185	F5
TANK 3 STBY 1 PUMP SUP	4-213	3Q835	A8
TANK 2 STBY 1 PUMP SUP	4-213	2Q835	B5
TANK 7-3 PUMP EMER CONT	4-213	Q900	C3
TANK 7-3 PUMP SUP	4-213	Q908	C8
TANK 5-1 PUMP EMER CONT	4-213	Q898	D3
TANK 5-1 PUMP SUP	4-213	Q905	D5
TANK 1 STBY 1 PUMP SUP	4-213	1Q835	F5
TANK 4 STBY 1 PUMP SUP	4-213	4Q835	F8
TANK 5A INNER PUMP SUP	13-215	Q902	A19
TANK 10 RH PUMP CONT	13-215	2Q184	B16
TANK 10 RH PUMP SUP	13-215	2Q190	C19
TANK 11 RH PUMP SUP	13-215	Q1376	E16
TANK 5-2 PUMP SUP	13-215	Q906	E19
TANK 4 STBY 2 PUMP SUP	13-215	4Q836	G16

R

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	TANK 8-3 PUMP SUP	13-215	Q910	G19
R	TANK 9 RH PUMP SUP	13-216	2Q189	B1
R R	TANK 7A INNER PUMP SUP	13-216	Q903	C4
R R	TANK 1 STBY 2 PUMP SUP	13-216	1Q836	D1
R	TANK 9 RH PUMP CONT	13-216	2Q181	E3
R	TRIM TRANS AUTO SUP	13-216	Q374	E4
R R	TANK 7-3 PUMP NORM CONT	13-216	Q899	E5
R	TANK 6-2 PUMP SUP	13-216	Q912	F1
R	TANK 11 LH PUMP SUP	13-216	Q1375	F4
R	TANK 9 LH PUMP SUP	14-215	1Q189	C17
R	TANK 9 LH PUMP CONT	14-215	1Q181	D15
R R	TANK 5A OUTER PUMP SUP	14-215	Q901	E14
R	TANK 7-4 PUMP SUP	14-215	Q907	E17
R R	TANK 3 STBY 2 PUMP SUP	14-215	3Q836	G14
R	TANK 6-1 PUMP SUP	14-215	Q911	G17
R	TANK 10 LH PUMP SUP	14-216	1Q190	B1
R	TANK 10 LH PUMP CONT	14-216	1Q184	C3
R R	TANK 5-1 PUMP NORM CONT	14-216	Q897	C4
R	TANK 8-4 PUMP SUP	14-216	Q909	D1
R	TANK 7A OUTER PUMP	14-216	Q904	D4

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP			
SCAVENGE PUMP SUP	14-216	Q491	E4
TANK 2 STBY 2 PUMP SUP	14-216	2Q836	F4
TANK 10 DE-AIR PUMP SUP	14-216	Q6666	F7
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20
TANK 4 JET VALVE SUP	15-215	Q134	D20
TANK 11 BLUE PUMP IND	15-215	2Q186	D22
TANK 11 RH PUMP CONT	15-215	Q188	D23
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22
TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
TANK 4 REFUEL VALVE SUP	15-215	Q521	E24
TANK 5 REFUEL VALVE SUP	15-215	Q518	E25
TANK 8 REFUEL VALVE SUP	15-215	Q519	F19
TANK 6 REFUEL VALVE SUP	15-215	Q520	F20
TANK 7 REFUEL SUP	15-215	Q517	F21

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH INLET VALVE MAIN SUP	15-215	Q361	G19
TANK 5 INLET VALVE MAIN SUP	15-215	Q363	G20
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q365	G21
TANK 5A-5 TRANS VALVE SUP & IND	15-215	Q6668	G24
TANK 2 JET VALVE SUP	15-216	Q132	B7
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
TANK 11 LH PUMP CONT	15-216	Q187	D3
TANK 9 RH INLET VALVE MAIN SUP	15-216	Q362	D4
TANK 7 INLET VALVE MAIN SUP	15-216	Q364	D5
TANK 11 RH INLET VALVE MAIN SUP	15-216	Q366	D6
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
R ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
TANK 5A REFUEL VALVE SUP	15-216	Q526	F4
TANK 7A REFUEL VALVE SUP	15-216	Q525	F5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 7A-7 TRANS VALVE SUP & IND	15-216	Q6669	F7
TANK 9 REFUEL VALVE SUP	15-216	Q515	F9
TANK 2 REFUEL VALVE SUP	15-216	Q524	F10
ENG 1 LP VALVE SUP 2	16-215	1Q2	-
ENG 4 LP VALVE SUP 2	16-215	4Q2	-

(8) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing, and disconnect the battery leads (Ref. 24-31-11).

R (9) Ventilate the fuel tank (Ref. para.7.).

R B. Preparation - Personal

R (1) Put on protective clothing as follows:-

(a) Put on all protective clothing as detailed in 28-00-00.

<u>NOTE</u>: It is not necessary to wear overshoes at this stage, unless tank entry is intended.

(b) Each operator will have two respirator masks, one of which is a standby. Check the operation of both masks, then don one.

R (2) Remove all loose items from pockets of overalls.

R (3) Remove all personal jewellery, watches, rings, etc.

R (4) Place all tools and equipment required for the maintenance operation in a shallow, open-topped, non-metallic container of a convenient size to allow unobstructed passage through internal

apertures (Ref. Fig. 305).

(5) Make a check-list of all tools and equipment to be taken in the tank, including cleaning materials. All these must be checked out on completion of the operation prior to sealing down any access panels.

(6) Agree with the attendant on the safety signs to be used in the event of the operator feeling unwell.

(7) Discharge any static electricity in the body by touching an identified earth: put on the overshoes (Ref. 28-00-00) and enter the tank.

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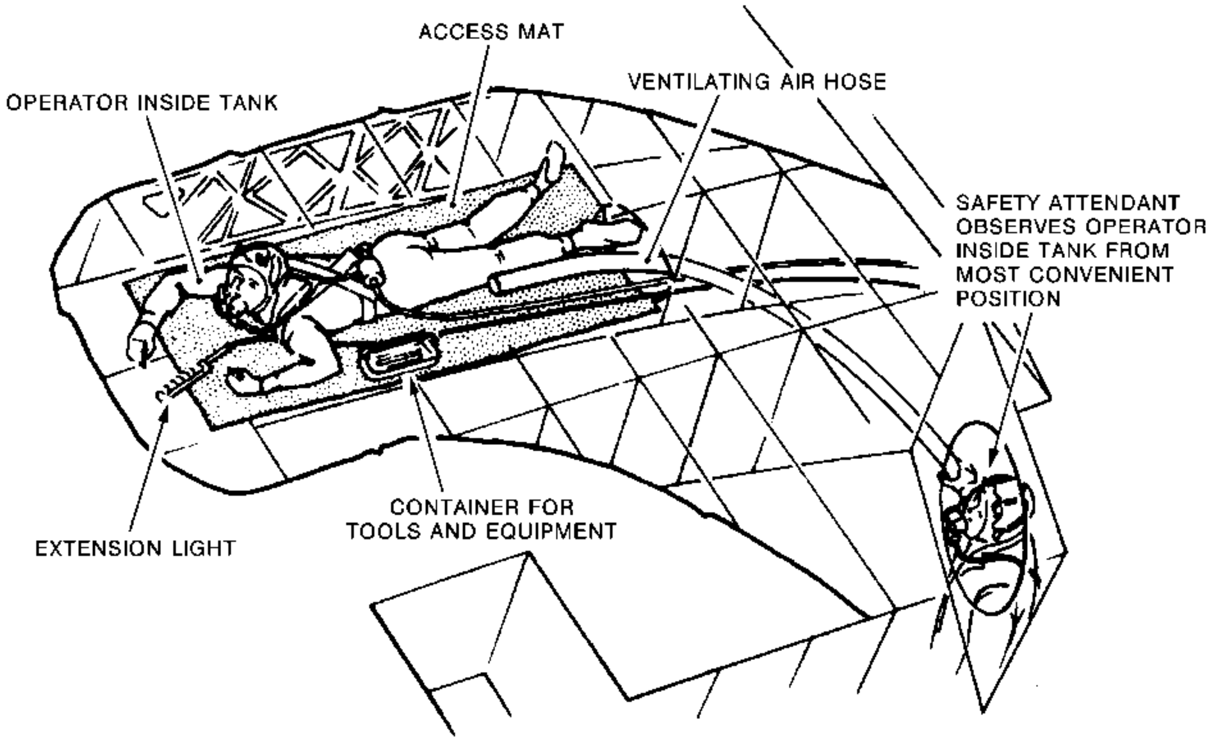

Typical Positions of Operators Maintaining a Fuel Tank
Figure 305

C. Procedure Inside the Tank

WARNING: KEEP WITHIN THE RECOMMENDED WORKING AREAS WHILE INSIDE THE TANK.

(1) Continue circulating the ventilating air while the operator is working inside the tank.

(2) When first entering a tank, and with the tank surfaces still wet with fuel, check for freedom from microbial contamination (Ref. 12-32-00, Microbial Contamination of Fuel Tanks).

RB (3) Mop up any puddles of fuel with Eurotwill cloth.

(4) Lay internal access mats on the floor of the tank in the area to be worked on (Ref. Fig. 305).

(5) Where possible in the tank, carry out the following inspections:

(a) Tank Pressure Relief Valve - floats for freedom of operation (Ref. 28-12-11).

(b) Air-no-fuel and Vent Drain Valves - floats for freedom of operation (Ref. 28-12-12).

(c) Thermal Non-return Valves - freedom of operation (Ref. 28-12-14).

(d) Burst Discs - freedom from damage (Ref. 28-12-16).

(6) Secure the floats of all vent valves and air-no-fuel valves in the tank in the closed position, using elastic bands with a warning tag attached, to isolate the tank from the main vent gallery and to prevent fumes or vapour from an unpurged tank from entering the tank.

(7) Continue to monitor the tank atmosphere with the combustible gas indicator to ensure that the atmosphere in the tank remains at a safe level.

6. Vacating a Fuel Tank

On completion of maintenance operations in a fuel tank, the following procedure must be adopted when the tank is vacated:

(1) Release the floats of all the vent valves and air-no-fuel valves in the tank, secured in operation 5.C.(6). Check for full and free movement of the valve floats.

(2) Refit any structure or equipment removed to complete the repair. (Refer to the appropriate maintenance section).

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(3) Remove all tools, equipment and cleaning materials from the tank. Check off every item on the check-list made when the equipment was taken into the tank. Do not seal down access panels until every item on the check-list is accounted for.

R (4) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

(5) Examine the bonding surfaces of the access panel, clamp ring and wing for corrosion and refit all access panels removed to enable the maintenance to be carried out. Torque-tighten the bolts in accordance with the relevant instruction.

(6) Remove all equipment placed around the aircraft for the maintenance operation.

(7) Reset any switches or circuit breakers tripped in the preparation sequences.

(8) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and reconnect the battery leads (Ref. 24-31-11).

(9) Remove all ropes and warning placards from the maintenance area.

(10) Refuel the tank (Ref. 12-11-28) and check access panels for leakage.

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7. Venting Fuel Tanks

When a tank has been defuelled, it must be vented as follows before entry:

(1) Remove all the access panels in the tank that are available for ventilation (Ref. Fig. 302 and 303).

NOTE: Before removing top surface panels it must be ensured that there are no loose items, e.g., nuts, bolts, and other foreign matter, which may accidentally drop into the tank.

For tanks 5A and 7A it is not necessary to remove all the access panels and purge the whole tank. Only the panel over the working area (Ref. para.3.E.) and the eight surrounding panels need to be removed, and that area of the tank must then be ventilated until it is dry. All safety precautions and procedure as for any other tank must be observed.

(2) Ventilate the fuel tank with clean, dry, filtered air from a compressor.

(a) Position an air compressor at a suitable distance from the aircraft (Ref. Fig. 304).

(b) Insert the end of the supply hose from the compressor into the tank through a convenient access hole.

(c) Switch on the compressor and check that the air is circulating through the tank.

(3) Continue the ventilating process for 6 h. At least one observer must stay in the area to check that the process continues satisfactorily.

NOTE: Any operator leaving the area during the initial venting period must remove all protective clothing and store it in a clean, dry place until it is required again.

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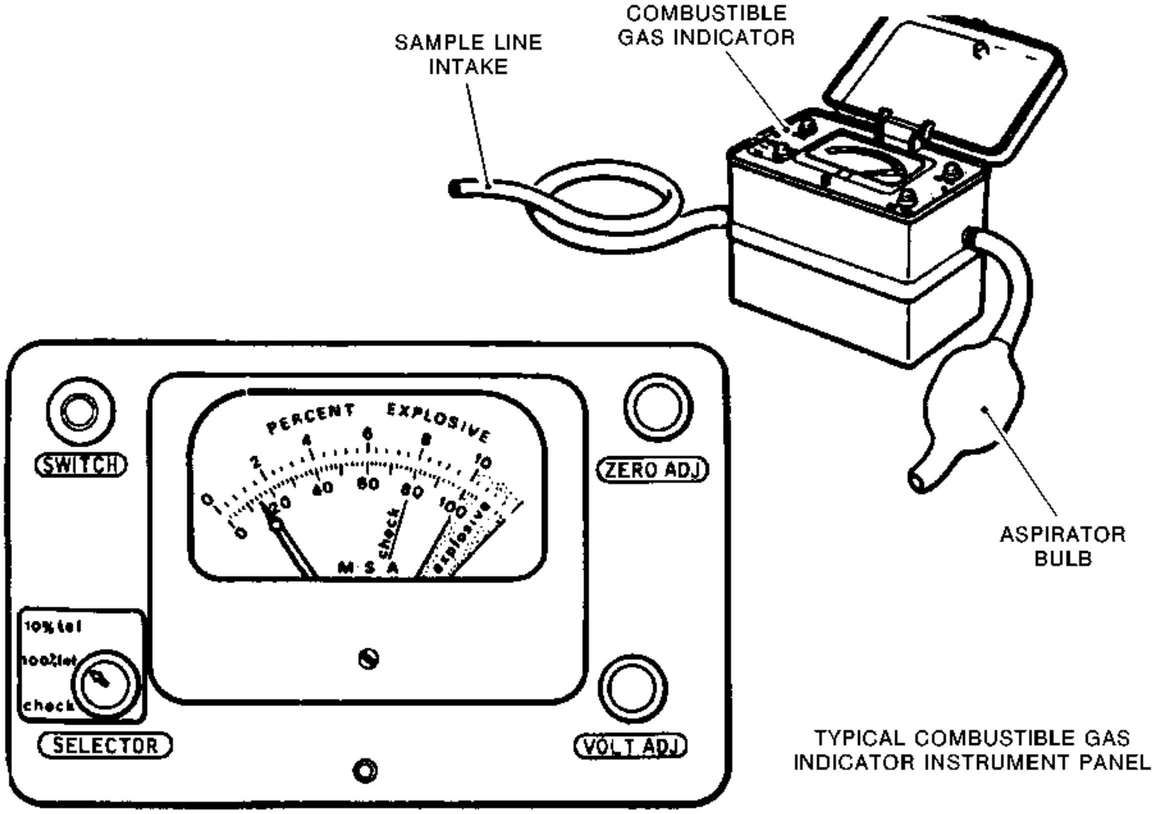

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Combustible Gas Indicator
Figure 306

(4) After 6 h, test the condition of the tank atmosphere with a combustible gas indicator (Ref. para.8.). If the indicator reading is above 25 per cent L.E.L. continue the venting process, taking readings at 15 min intervals until the reading is below 25 percent L.E.L.

NOTE: With a combustible gas indicator reading between 5 and 25 percent L.E.L. the tank may be entered, provided breathing apparatus is worn. with a reading below 5 percent L.E.L. it is safe for a tank to be entered without breathing apparatus, provided the safety precautions detailed in paragraph 2.(2) are observed.

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8. Use of Combustible Gas Indicator (Ref. Fig. 306)

The combustible gas indicator is used to test the condition of fuel tank atmosphere. The procedure for using the Mines Safety Appliances Model 40 (calibrated for pentane) indicator is detailed below. When using alternative instruments refer to the appropriate manufacturer's instructions. To use the instrument:

(1) Put on protective clothing and breathing apparatus (Ref. 28-00-00).

(2) Place the sample line intake in fresh air.

(3) Select "CHECK".

(4) Pull out the "SWITCH".

(5) Squeeze the aspirator bulb several times to purge the instrument of any gases remaining from previous tests.

(6) Adjust the VOLT-ADJ knob until the pointer is on "CHECK".

NOTE: When the VOLT-ADJ knob is turned fully to the right and the pointer is below CHECK, the dry cells must be replaced.

(7) Select "100 percent L.E.L.".

(8) Adjust the ZERO-ADJ knob until the pointer is on zero. Turn the knob so that the pointer slightly overshoots zero, then turn the knob slowly in the opposite direction until the pointer is on zero.

(9) Select "10 percent L.E.L..

(10) If necessary, adjust the ZERO-ADJ knob until the pointer is on "ZERO".

(11) Select "100 percent L.E.L.".

(12) Place the sample line intake in the fuel tank.

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(13) Squeeze the aspirator bulb several times to draw a sample through the indicator. Continue until the highest reading is obtained.

WARNING: IF THE POINTER RISES FROM ZERO TO THE TOP OF THE SCALE (WITH 100 PERCENT L.E.L. SELECTED) AND STAYS THERE, IT INDICATES A CONCENTRATION OF COMBUSTIBLE GAS NEAR OR ABOVE THE LOWER EXPLOSIVE LIMIT. VAPOUR MIXTURES GIVING SUCH READINGS CAN BE VIOLENTLY EXPLOSIVE. THE INSTRUMENT MUST BE SWITCHED OFF TO PREVENT AN EXPLOSION OCCURRING IN THE COMBUSTION CHAMBER.

(14) If the reading is below 10 percent, select "10 percent L.E.L." and take the reading off the top scale.

(15) When the test is finished, purge the instrument as detailed in paragraph (2) to (5).

(16) Push the "SWITCH" in to switch off the instrument.

NOTE: When a combustible gas indicator is being used to check tank atmosphere, readings must be taken in at least four different locations in the tank.

9. Aircraft Storage - Fuel System

A. General

Before an aircraft is stored for longer than the specified period the fuel system must be treated with a biocide. This paragraph details the procedure for such treatment and the procedure for preparing the system for use after storage (destorage/ reactivation). The information is complementary to that in 10-31-00.

The procedures are based on the assumption that the fuel system is fully equipped and serviceable.

The concentration of the biocide (BIOBOR JF) in the fuel, for storage, is 135 ppm (parts per million) by weight.

For the periodic checks required during storage, reference should be made to 10-31-00, paragraph 7.F.(9), 'Storage Check', and (10), 'Special Instructions'.

NOTE: After every 6 months and on reactivation a visual inspection, through over-wing access panels, for microbial contamination must be carried out on a sample of two fuel tanks.

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B. Equipment and Materials

DESCRIPTION	PART NO.
Water drain tool, ambient sense	D925097000
Water drain tool, for operating water drain valves	D925373000
Water drain tool, as above, with extended handle	E925094000
Plastic bottle, 1.75 pints (Imp.) (1.0 l) approximately, for collecting fuel samples	-
Metering injector, for use with refuelling adapter (manufactured by most refuelling equipment suppliers)	-
Biocide (BIOBAR JF), 3.5 pints (Imp.) (2 l) (Borax Holdings Ltd., Borax House, Carlisle Place, London, England. SW1P 1HT (Code K3714)	-
(Borax Francais/STE/SA, 8 Rue de Lorraine 78, Saint-Germaine-en-Laye, France. (Code F4981))	-
(U.S. Borax and Chemical Corporation, 3075 Wilshire Blvd., Los Angeles, California 90010, P.O. Box 2781, U.S.A. (Code 24611))	-

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C. Fuel System Storage

WARNING: OBSERVE THE AIRCRAFT GROUND STABILITY PRECAUTIONS DETAILED IN 12-00-10.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

CAUTION: THE FUEL USED MUST NOT HAVE ANTI-ICING ADDITIVES THAT CONTAIN GLYCEROL.

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(1) Defuel and drain the aircraft (Ref. 28-25-00, Servicing - Complete Defuelling).

NOTE: Biocide BIOBOR JF may be added by a metering injector, used in conjunction with the refuelling facility (Ref. para.(2)(a)), or by pouring it into a partially filled tank (Ref. para.(2)(b)).

(2) Introduce biocide into the fuel system by either of the following methods, (a) or (b), as convenient.

WARNING: WHEN HANDLING BIOCIDE 'BIOBOR JF', OBSERVE THE MANUFACTURER'S SAFETY PRECAUTIONS. SEE ALSO 'U.S. BORAX' SERVICE BULLETIN NO.978.

(a) Refuel, using the metering injector to mix biocide BIOBOR JF with the fuel, as follows:

a1) Refuel (Ref. 12-11-28) each of tanks 9 and 10 to 2,200 gal (Imp.) (7,890 kg), i.e., 4,400 gal (Imp.) (15,780 kg) total.

a2) Using tank 9 RH trim pump and tank 10 standby inlet valve, transfer fuel from tank 9 to tank 10 until the standby inlet valve closes automatically (high level shut-off).

(b) Add biocide BIOBOR JF to fuel in tanks, as follows:

b1) Remove access panels 521 CT (T.9 LH), 522 FT (T.10 LH), 621 CT (T.9 RH) and 622 BT (T.10 RH).

b2) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

b3) Refuel (Ref. 12-11-28) each of tanks 9 and 10 to 2,200 gal (Imp.) (7,890 kg), i.e., 4,400 gal (Imp.) (15,790 kg).

b4) When each tank contains at least 278 gal (Imp.) (1,000 kg), divide the 3.5 pints (Imp.) (2 l) of biocide BIOBOR JF into four approximately equal portions and pour one into each of the four tank cells. Refit the access panels and complete the refuelling.

b5) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

b6) Set tank 9 MAIN trim INLET VALVE switches to "OPEN". Check that the associated magnetic indicators display changes to bar-in-line.

CAUTION: AFTER SB 28-048, TANKS 9 AND 10 TRIM PUMPS MUST NOT BE SWITCHED ON MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

b7) Set tank 10 LH and RH PUMP switches to "ON". Allow fuel to transfer into tank 9 until tank 9 inlet valves close automatically (high level shut-off). Set tank 9 INLET VALVE switches and tank 10 PUMP switches to "AUTO".

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R b8) Set tank 10 STANDBY INLET VALVES switch to "OPEN". Ensure that the associated magnetic indicator displays OPEN.

R b9) Set tank 9 RH PUMP switch to "ON". Allow fuel to transfer into tank 10 until the standby inlet valve closes automatically. Set tank 10 STANDBY INLET VALVES switch to "SHUT" and tank 9 RH switch to "AUTO".

R b10) Repeat operations b5) to b8) four times.

(3) Using the fuel from tank 10 only, wet other fuel tank surfaces as follows:

NOTE: At the conclusion of each transfer operation the pumps must be switched off and the valves closed.

(a) Using tank 10 LH and RH pumps and tanks 6 and 8 STANDBY INLET VALVES switches, transfer 1680 gal (Imp.) (6,000 kg) into each of tanks 6 and 8.

(b) Using tanks 6 and 8 LH and RH pumps, transfer 840 gal (Imp.) (3,000 kg) into each of tanks 1, 2, 3 and 4.

(c) Using tanks 1 and 4 JETTISON VALVES, standby engine feed pumps and tanks 5 and 7 STANDBY INLET VALVES, transfer 840 gal (Imp.) 3(,000 kg) into each of tanks 5 and 7.

(d) Using tanks 2 and 3 JETTISON VALVES, standby engine feed pumps, and tank 5A and 7A refuel inlet valve switches on the refuel control panel, transfer fuel until tanks 5A and 7A refuel magnetic indicators display black. Set the refuel inlet valves to "SHUT" and close the refuel control panel door.

(e) Using tanks 5A and 7A TRANS VALVES and PUMPS, transfer fuel into tanks 5 and 7 until tanks 5A and 7A fuel quantity indicators (FQIs) show 500 kg, and then stop the transfer.

(f) Using tanks 5 and 7 LH and RH PUMPS, transfer fuel into tanks 1, 2, 3 and 4 until tanks 5 and 7 are empty.

(4) Using tanks 3 and 4 standby ENGINE FEED PUMPS and JETTISON VALVES, transfer fuel to tank 10 by opening tank 10 standby inlet valve.

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(5) Transfer fuel from tanks 1 and 2 to tanks 9 and 10, as follows:

(a) Using tanks 1 and 2 JETTISON VALVES, standby engine feed pumps and tank 9 LH MAIN INLET VALVE, transfer fuel into tank 9.

(b) While fuel is transferring into tank 9 use tank 9 RH PUMP and tank 10 STANDBY INLET VALVE to transfer fuel into tank 10.

(c) Allow fuel to transfer from tanks 1 and 2 to tank 9 until the pump LOW PRESS captions are illuminated, and then switch off the pumps and close the valve.

(d) Allow fuel to transfer from tank 9 to tank 10 until the standby inlet valve closes automatically. Set tank 10 STANDBY INLET VALVE switch to "SHUT" and tank 9 RH PUMP switch to "AUTO".

(6) Using tank 10 trim pumps, redistribute the fuel from tank 10 only, as follows:

(a) Using the STANDBY INLET VALVES, transfer 278 gal (Imp.) (1,000 kg) into each of tanks 1 and 4.

(b) Using the STANDBY INLET VALVES, transfer 278 gal (Imp.) (1,000 kg) into each of tanks 5, 6, 7 and 8.

(c) Using the STANDBY INLET VALVES, transfer 278 gal (Imp.) (1,000 kg) into each of tanks 2 and 3.

(d) Using tank 11 MAIN INLET VALVES, transfer 278 gal (Imp.) (1,000 kg) into tank 11.

(e) Check that the final contents state of the fuel tanks is as follows:

Tank 9 - more than 1115 gal (Imp.) (4,000 kg).

Tank 10 - more than 278 gal (Imp.) (1,000 kg).

Tanks 5A and 7A - not less than 140 gal (Imp.) (500 kg) each.

Tanks 5 and 6 - not less than 278 gal (Imp.) (1,000 kg) each.

Tanks 7 and 8 - not less than 278 gal (Imp.) (1,000 kg) each.

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Tanks 1, 2, 3 and 4 - not less than 278 gal (Imp.) (1,000 kg) each.

Tank 11 - not more than 278 gal (Imp.) (1,000 kg).

(7) Using the ENGINE FEED PUMPS and CROSSFEED valves, flush through the engine feed system as follows:

NOTE: Fuel will flow via the cross-feed valves, LP valves, engine recirculation valves and tank recirculation system.

(a) Transfer 55 gal (Imp.) (200 kg) of fuel from tank 2 to tank 4.

(b) Transfer 55 gal (Imp.) (200 kg) of fuel from tank 3 to tank 1.

(c) Transfer 55 gal (Imp.) (200 kg) of fuel from tank 1 to tank 2.

(d) Transfer 55 gal (Imp.) (200 kg) of fuel from tank 4 to tank 3.

(8) Using tank 10 LH and RH pumps, flush the scavenge tank as follows:

(a) With tank 10 pumps on, set the TRIM PIPE DRAIN switch to "OPEN" for 1 min only.

(b) Check that the SCAVENGE PUMP magnetic indicator display changes from OFF to ON.

(c) Set the TRIM PIPE DRAIN switch to "SHUT". Check that within 30 s the SCAVENGE PUMP indicator display changes to OFF.

(9) Carry out water drain checks (Ref. 12-11-10).

(10) Blank off the vent system as detailed in 10-31-00.

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D. Destorage/Reactivation

(1) Carry out a visual inspection of a pair of tanks for freedom from microbial contamination, as follows:

(a) Remove a LH and RH tank access panel (Ref. Table 301).

TANK	PANEL	TANK	PANEL
1	524 DT	4	624 DT
2	526 AT	3	626 AT
5	524 JT	8	624 JT
6	525 ST	7	625 ST

Tank Panels
Table 301

(b) Visually check each tank for freedom from microbial contamination.

NOTE: The inspection should be carried out with the fuel still in the tanks. Viewed through the fuel the appearance of the growth is quite distinctive and it is generally only necessary to distinguish between a tank interior of bright new appearance and one largely spotted with dark patches of fungal growth. During the inspection particular attention should be paid to low areas of the tank floor and vertical faces of tank structure.

R (c) Prior to tank close-up, visually inspect all bonding
R leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken,
R frayed, or with braid loose in the crimp is to
R be replaced before the next flight.

R Bonding leads which show signs of surface
R corrosion only (characterized by sooty deposits
R or tarnishing) may be left installed.

R (d) Refit the access panels.

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(2) Remove the blanking materials used on the vent system.

(3) Carry out water drain checks (Ref. 12-11-10 and 12-32-00).

NOTE: If the fuel in the aircraft is free from microbial debris, it is fit for use.

(4) Operate the ambient sense line drain valve (Ref. 28-12-62).

(5) Carry out the following tests:

NOTE: Pre-refuelling checks are carried out during normal refuelling.

During the following tests, a check must be made, where possible, for freedom from fuel leaks.

(a) Vent System (Ref. 28-12-00).

a1) Scavenge pump (including trim pipe drain valve) - Operational Test.

a2) Overflow relief valve - Operational test.

a3) Vent shut-off valve - Operational Test.

a4) Vent inward relief valve - Operational Test.

a5) Vent system pressure switches control and function - System Test.

(b) De-aeration System (Ref. 28-13-00).

b1) Tanks 10 and 11 - Operational Test.

(c) Engine Feed System (Ref. 28-21-00).

c1) LP isolation valves - Operational Test.

c2) Accumulator and bypass valve - Functional Test.

c3) Flow test via crossfeed valves - Functional Test (Ref. 28-21-17).

(d) Main Transfer System (Ref. 28-22-00).

d1) System flow rate test.

d2) Interconnect valve flow test.

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(e) Trim Transfer System (Ref. 28-23-00).

e1) Automatic transfer - Functional Test.

(f) Dump System (Ref. 28-31-00).

f1) Operational Test.

(g) Leakage (Ref. 28-41-00).

g1) Functional Test.

(h) Fuel Level Indication (Ref. 28-42-00).

h1) Functional Test.

(j) Fuel Quantity Indication (Ref. 28-44-00).

j1) Operational Test.

(k) Fuel Temperature Indication (Ref. 28-45-00).

k1) Operational Test.

(6) Refuel (Ref. 12-11-28) the aircraft to Flight/Maintenance requirements.

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TANKS - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001)

The fuel is stored in thirteen storage tanks, arranged in three groups to facilitate redistribution of fuel for trimming the aircraft under all conditions of flight. The three groups are left main transfer group, right main transfer group and trim transfer group.

The tanks, which are formed as sealed cells integral with the aircraft structure, are in the wings, parts of the centre fuselage and part of the rear fuselage. To prevent fuel vapour entering the cabin, a vapour-seal membrane forms a double skin over the fuselage fuel tank cells. This area is pressurized and vented overboard (Ref. 21-00-00).

Intermediate ribs and spars in the tanks reduce fuel surging and sloshing. The areas of the tanks 1, 4, 5, 6, 7 and 8 (on the wing lower surface) are equipped with liners, they limit the fuel leakage to a minimum in case of foreign object damage. For detailed installation of the liners on the structure, see (Ref. 57-10-00). The tanks contain the majority of the fuel system pipes and components, the components are readily accessible and can generally be removed without draining the tanks.

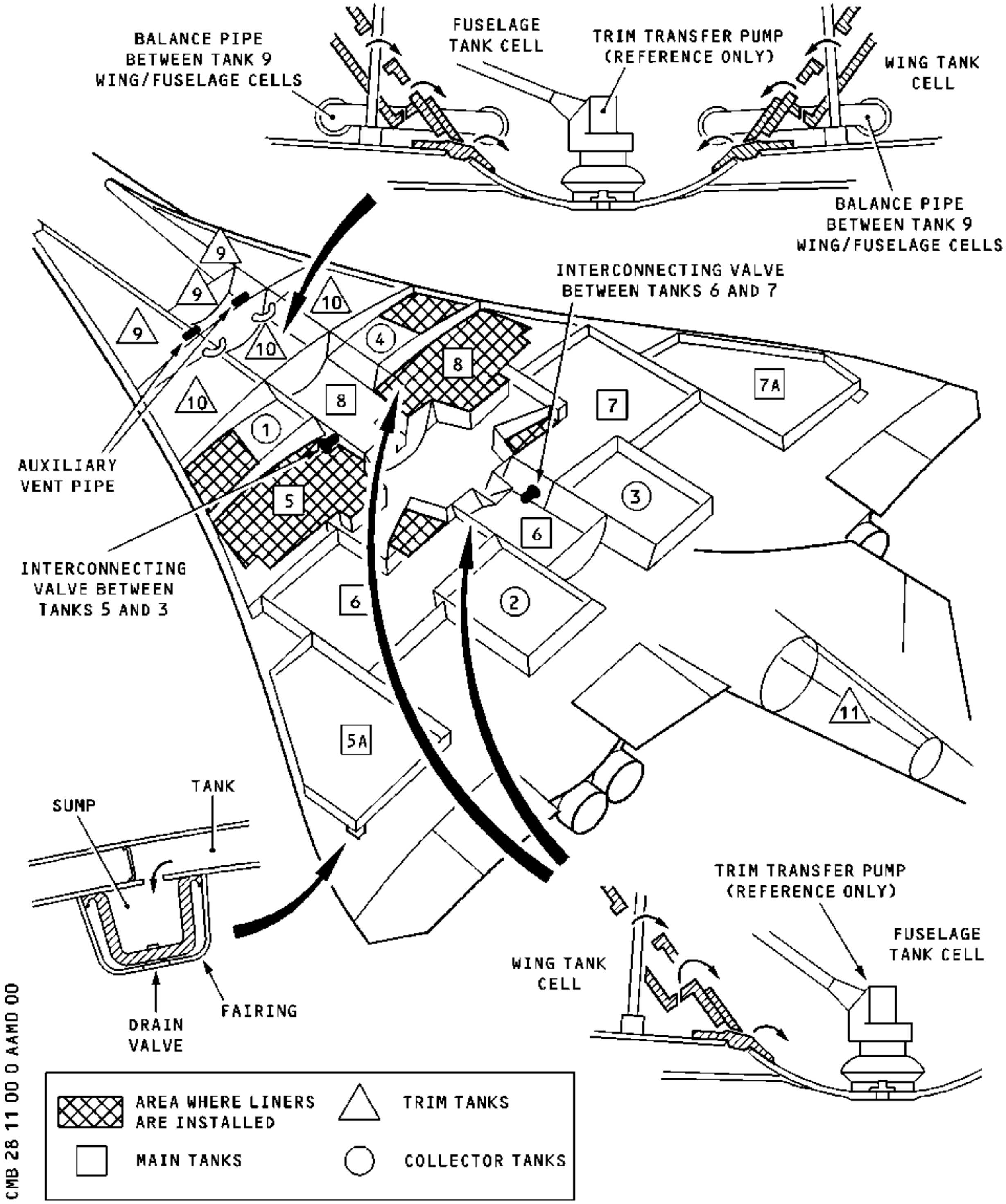
Valves, installed at low points in the tank floors, allow water or contaminated fuel to be drained without appreciable loss of fuel. These valves also allow drainage of residual fuel in the tank after defuelling.

Access to equipment installed in the tanks is through removable sealed panels. Each tank has a zone reference and each panel has identifying letters for maintenance and servicing purposes.

Tanks 5, 6, 7, 8, 9, 10 and 11 are fitted with magnetic fuel level indicators to provide an underwing method of manually checking the contents of a tank filled to between 15 and 90 percent. These indicators are used when a fuel quantity indicator has failed or when the fuel quantity probes are suspected of giving incorrect signals. The indicators do not provide a check of tank high fuel levels since these levels can be checked independently by the level switching system. Indicators are not installed in collector tanks and tanks 5A and 7A, which are normally refuelled to the high level condition for flight.

2. Tank Capacities

Total and individual tank capacities, at fuel specific gravity 0.80, are given in Table 1.



Fuel Tank Arrangement
Figure 001

R
R

3. Fuel Leaks

A fuel leakage indication system gives warning if excessive leakage occurs in the dry compartment above each engine nacelle. Any fuel or hydraulic fluid leaking into these compartments is drained overboard.

4. Tank Access Panels (Ref. Fig.002 and 003)

The majority of the access panels are in the wing and fuselage skin plates. The exceptions are either where an item of equipment incorporates a cover plate which lies flush with the skin surface, when the access panel is in a tank wall forming part of the main landing gear bays, or when the access panel is in the internal tank structure.

The external access panel assemblies are clamped to flanges which are secured and sealed in recesses machined in the skin plates. Captive, countersunk bolts in the flanges pass through holes in the panels to screw into self-sealing and locking, domed anchor nuts riveted to clamp rings. Rubber seals, bonded into shallow grooves machined in the panel surfaces and the attachment posts, make the assemblies fuel-tight.

	TANK	IMP. GAL.	U.S. GAL.	LITRES	LBS.	KGS.
R	1	1,157	1,390	5,261	9,280	4,209
	2	1,269	1,524	5,770	10,180	4,620
	3	1,269	1,524	5,770	10,180	4,620
R	4	1,157	1,390	5,261	9,280	4,209
R	5	1,982	2,380	9,013	15,900	7,210
	5A	618	743	2,810	4,950	2,250
R	6	3,215	3,860	14,616	25,780	11,693
R	7	2,052	2,465	9,329	16,450	7,463
	7A	618	743	2,810	4,950	2,250
R	8	3,547	4,260	16,125	28,440	12,900
	9	3,082	3,701	14,010	24,710	11,210
	10	3,317	3,984	15,080	26,580	12,060
	11	2,893	3,474	13,150	23,200	10,520
R	TOTALS	26,176	31,438	119,005	209,880	95,214

Approximate Tank Capacities
Table 1

Access panels in the main landing gear bay walls are fitted inside the tanks. The securing bolts have forked ends and are hinged to the panels. A moulded synthetic rubber strip, bonded to the panel, provides the seal. With the panel installed, the bolts pass through stirrups which bear on both external surrounds of the tank opening and the outside face of the panel. Nuts are fitted on the bolts and when tightened down on the stirrups they draw the panel outward to make a fuel-tight joint against the inside wall of the tank.

Removable panels in vertical bulkheads, or frames within fuselage tanks 6, 8 and 11, facilitate access to equipment in the tanks and to the tank structure. Single panels in tanks 6 and 8 are fastened by studs and locknuts to a bulkhead, and four panels in tank 11 are secured by bolts and anchor nuts to frames. All these panels are unsealed.

Fuel tank access panels in the wings are specially treated to ensure satisfactory electrical bonding. Some of the access panel clamping rings also form part of the equipment inside the tank, in these cases, the electrical bonding is made with metal bonding strips between the equipment and the adjacent structure.

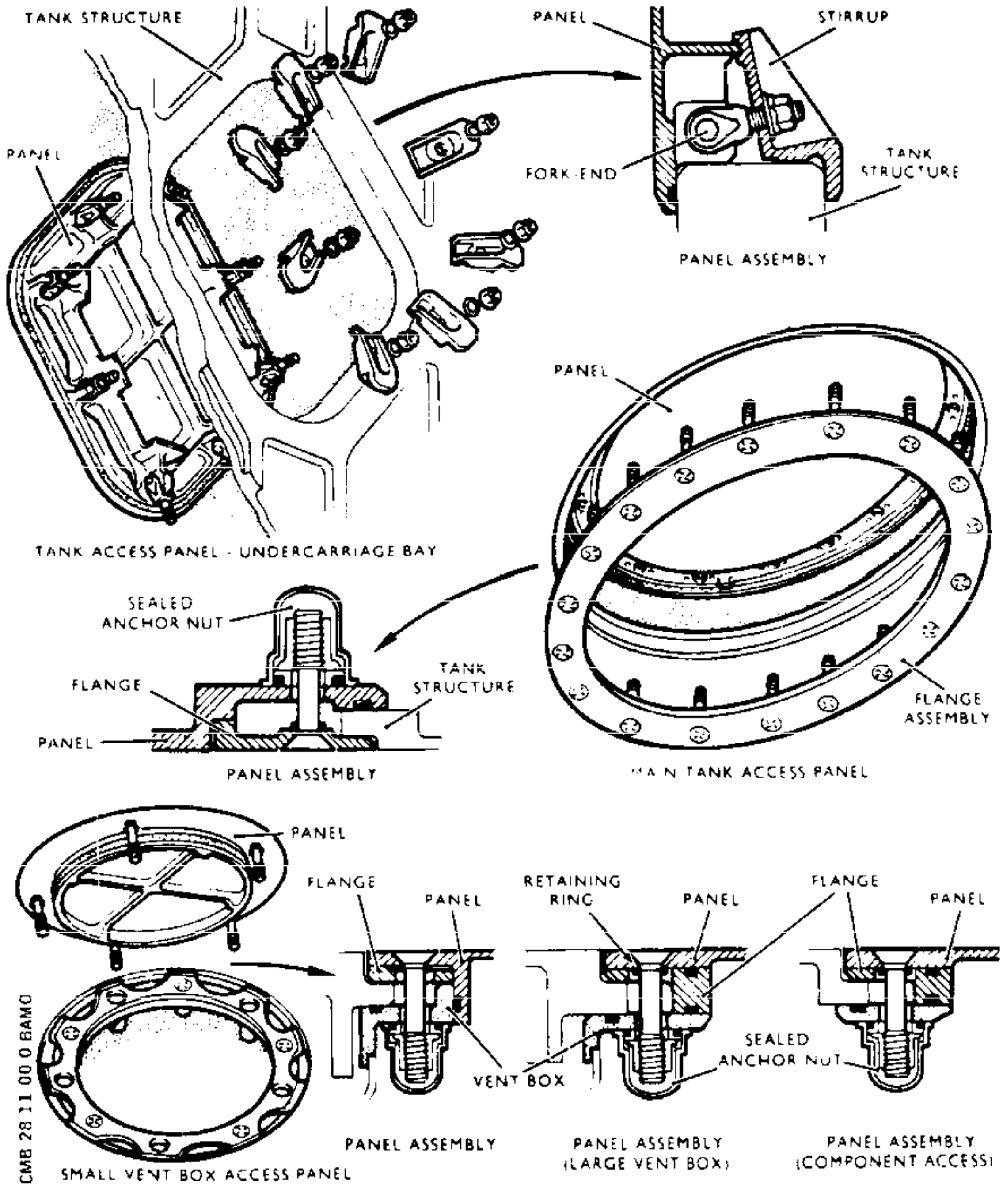
5. Tank Sealing

The structural members of the wings and fuselage which form the fuel cells are sealed with synthetic rubber compounds, applied by techniques involving
R interfaying, filletting and injection. The liners are sealed on the bottom of
R the fuel tanks with a synthetic rubber compound (Ref. 20-22-12). On completion of the detail manufacture, all structure surfaces in contact with the fuel are treated with a primer and a high temperature baked epoxy resin coating.

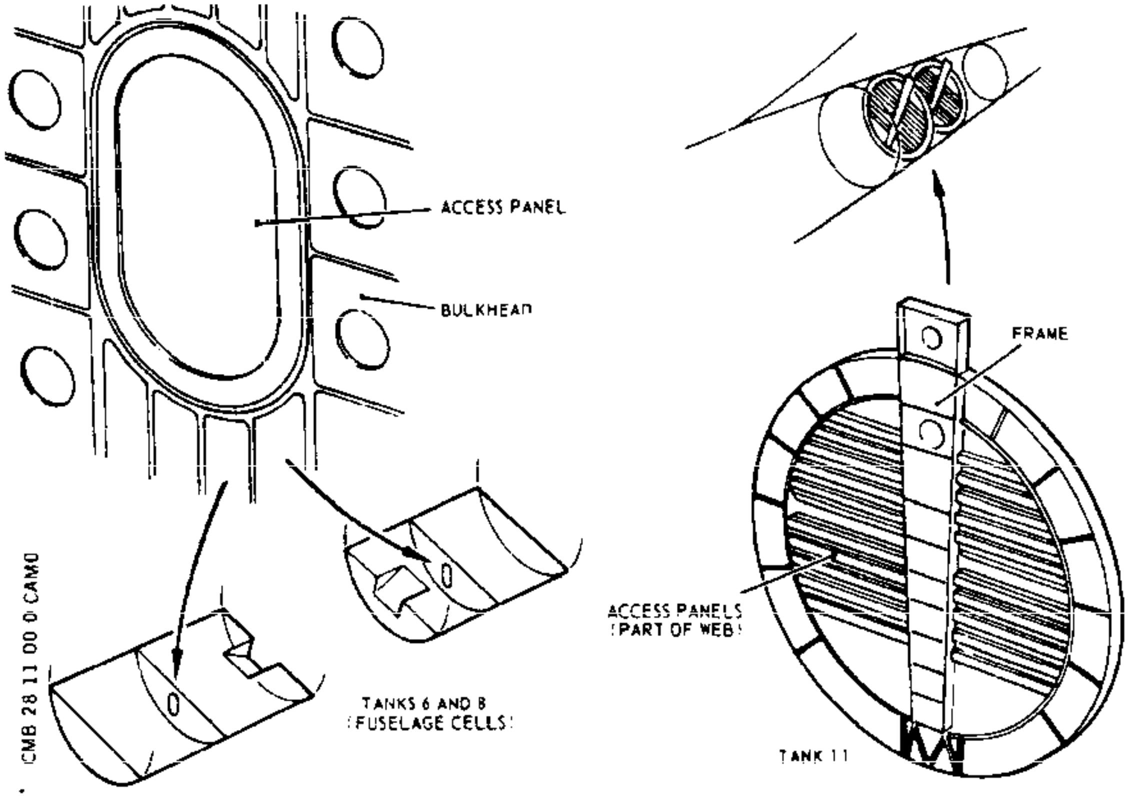
6. Removable Component Seals

The type of seal used for removable components which penetrate the fuel tank walls is determined by their

(continued on 28-11-00 Page 6)



External Access Panels (Typical)
Figure 002



Internal Access Panels
Figure 003

location in the tank structure. Where removable components are bolted to the tank walls, O-ring seals or moulded synthetic rubber seals bonded to the component provide the seal between the tank wall and the component. The securing bolts pass through the tank walls into self-sealing domed anchor nut installations. Bolts carrying primary tension loads are sealed with O-rings, installed under the bolt heads, and special washers; bolts which require removal in service are sealed with standard seal washers.

Units such as pumps and valves, which are housed in isolating canisters to enable them to be removed without draining the tanks, incorporate mechanical devices for shutting-off the fuel from the tanks. The devices utilize O-ring seals extensively whenever removable fuel-tight seals are needed.

7. Main Transfer Tank Groups (Ref. Fig. 001)

The left and right main transfer groups each contain a main tank and its associated outer wing tank (tanks 5, 5A and 7, 7A), a main tank incorporating a fuselage cell (tanks 6 and

8), and front and rear collector tanks (tanks 1, 2 and 3, 4). Each group has its own system of pumps and control valves for transferring fuel from the main tanks to the collector tanks; the engines are fed from the collector tanks.

The fuselage cells of tanks 6 and 8 connect with their wing cells through holes in the fuselage plates and with tanks 7 and 5 through interconnect valves and pipes. This allows gravity fuel flow if the tank pumps fail.

The outer wing tanks, 5A and 7A, are auxiliary main tanks; they differ from the other main tanks in that their fuel is delivered to the associated main tanks 5 and 7 and not direct to the collector tanks. A fuel sump is attached underneath each outer wing tank and two fuel pumps are mounted externally on each of these sumps. A common manifold, integral with the sump body, receives the fuel from both pumps and delivers it through a single pipe to the associated main tank. The complete sump installations, with fuel pumps, non-return valves and pressure switches, are covered by detachable fairings forming part of the wing bottom surfaces.

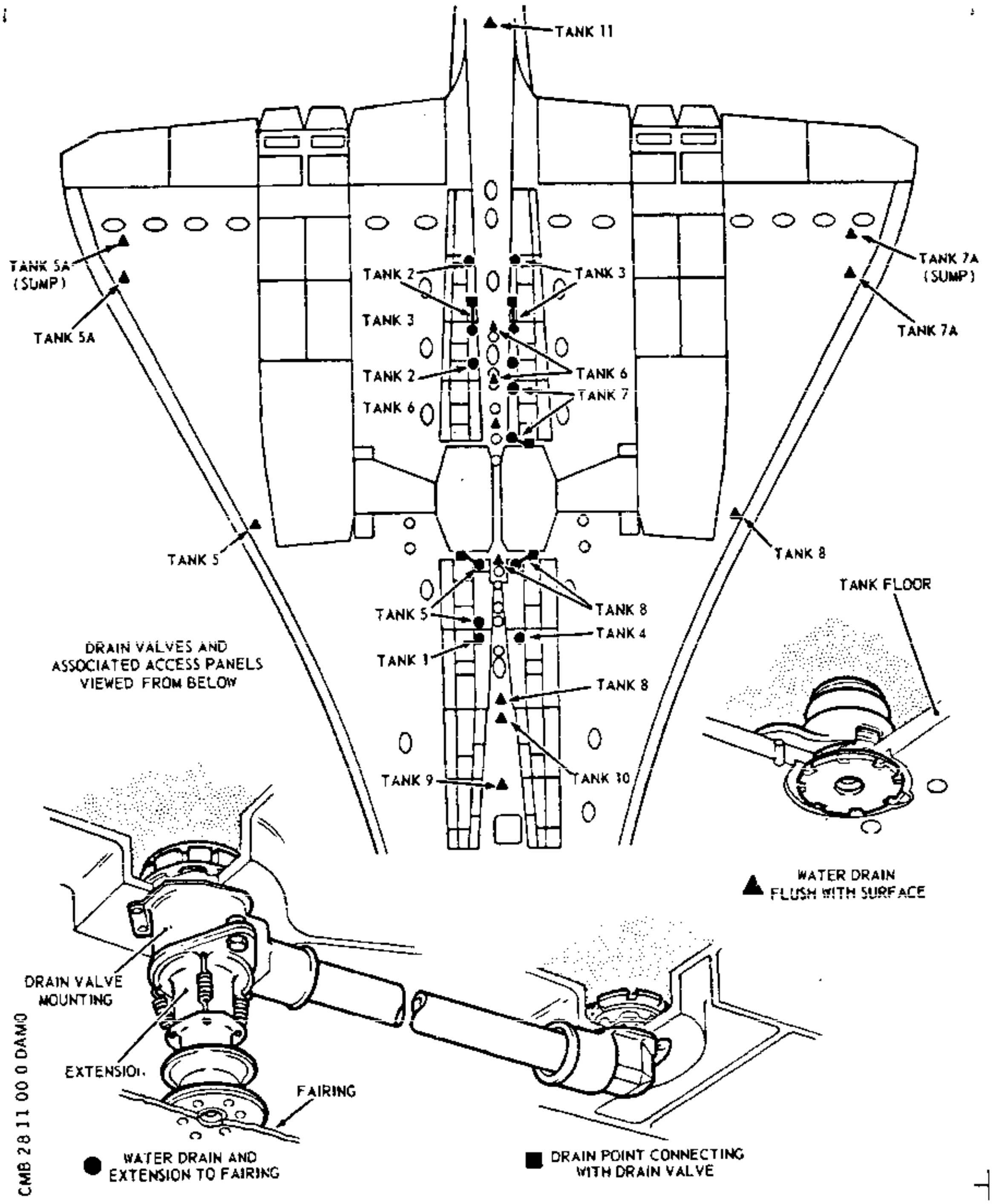
8. Trim Transfer Tank Group (Ref. Fig. 001)

The trim transfer group comprises two tanks (tanks 9 and 10) forward in the wings and a single tank (tank 11) in the rear fuselage. A system of pumps and control valves transfers fuel between the front and rear trim tanks and from the trim tanks to the main tanks. This procedure enables the aircraft to be trimmed to suit the requirements of subsonic and supersonic flight.

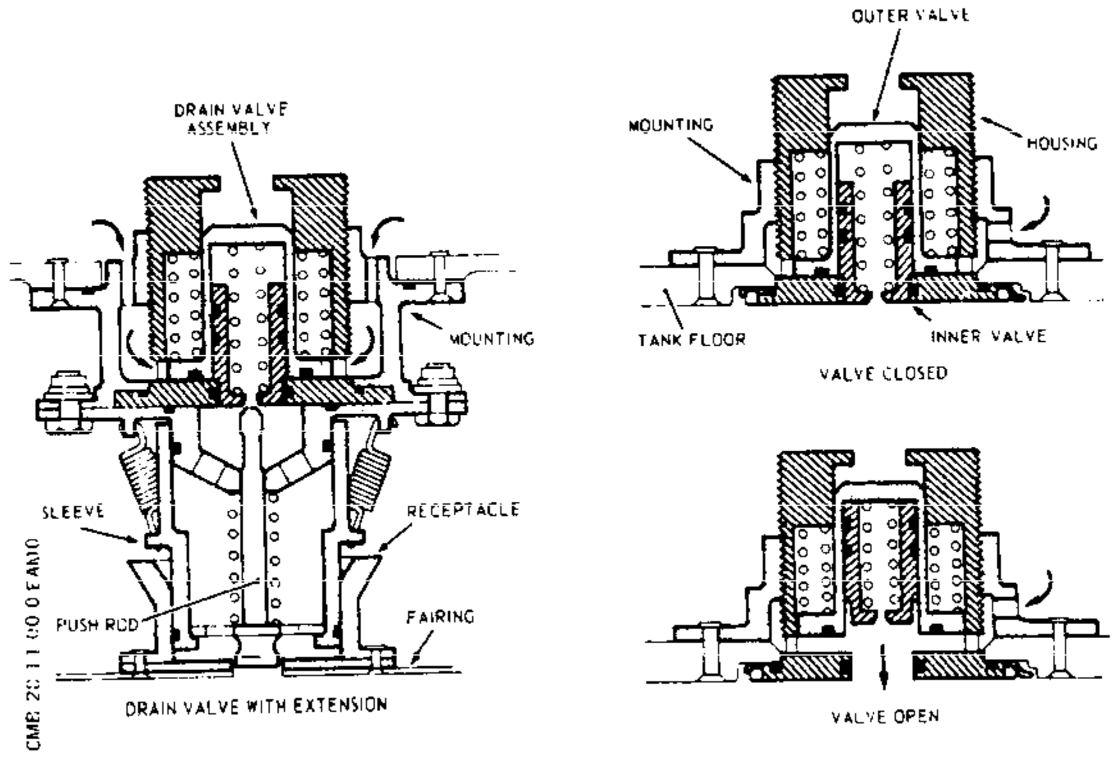
The forward trim tank 9 has three cells, one in each wing and one in the centre fuselage: the wing cells are connected to the fuselage cell by balance pipes which pass through tank 10. Flexible vent balance pipes are fitted between the wing and fuselage cells of tank 9. Tank 10 extends across the wings and fuselage and is formed in three cells which are interconnected by holes in the fuselage walls. The rear trim tank 11 occupies all the fuselage between frames 81 and 88.

Fuel is transferred between front and rear trim tanks through two pipes, one of which passes through the main tanks on each side of the aircraft. These trim pipes, together with associated branch pipes, interconnect the trim tanks and the main tanks and also serve other fuel sub-systems.

9. Water Drain Valves (Ref. Fig.004 and 005)



Drain Points - Location
Figure 004



Water Drain Valve Assemblies
Figure 005

Water drain valves are provided at the low points of each tank. Where access to a drain point can be made directly from beneath the tank, a drain valve assembly is installed inside the tank, its face flush with the aircraft skin. Where a drain point is covered by a fairing, the valve assembly is installed below the tank with an extension between the valve and the fairing. At more inaccessible drain points, the water collects in small sumps machined in the tank floor and gravitates through pipes to nearby drain valves. The drain points for the outer wing tanks are in the tank sumps.

The drain valves are manually opened by pushing upwards with a drain tool to which a tube can be attached to enable drained fluid to be collected. The valves return to the fully closed position automatically when the tool is removed; they cannot open inadvertently and will not open under flight conditions. At least two seals are provided in any possible leak path in each valve, and service checks on the sealing of a valve assembly can be made with a fuel loss of less than 5 ml.

The drain valve assemblies are screwed and locked in mountings sealed and secured to the tank floors. Each valve assembly comprises a housing and two concentric valves, one operating inside the other. The outside valve has two retaining springs, each of which is strong enough to overcome a single spring in the inner valve. O-ring seals prevent leakage between the valves. The outer valve seats on a face seal and the inner valve is sealed at the housing by an O-ring which can be changed in situ without loss of fuel. Provision is made for checking both seals; the face seal by pushing the inner valve upward sufficiently to release the O-ring seal and the O-ring seal by using a probe to lift the outer valve clear of its seat.

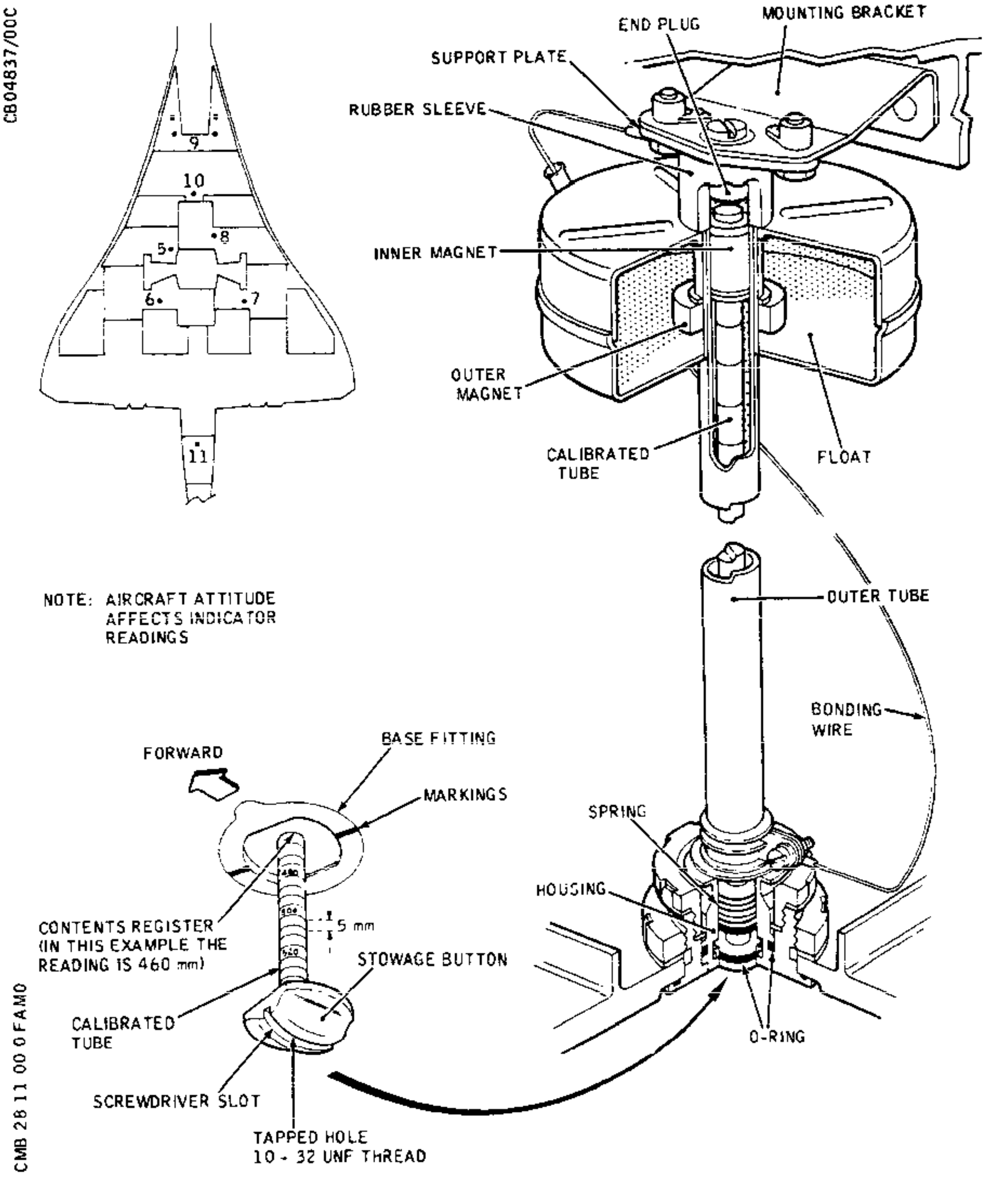
A drain valve extension consists of a sleeve telescoped internally by the base of the valve mounting and externally by a receptacle attached to the inside of the fairing. The sleeve is held to the valve mounting by three tension springs; O-ring seals provide the sealing between the sleeve and the other parts. A push-rod, held away from the valve by a spring, is operated through a hole in the fairing.

10. Magnetic Level Indicators (Ref. Fig. 006, 007 and 008) (Ref. Fig. 009)

Each magnetic level indicator (MLI) comprises a sealed outer tube on which slides a float-mounted magnet, the position of which is determined by the level of fuel in the tank. An inner tube, calibrated in increments of 5 mm and numbered every 20 mm, carries a ring magnet, fixed at its upper end. The inner tube slides inside the outer tube to allow both magnets to link and thus provide an indication of the fuel level in the tank.

A bonding wire, running through a tube on the side of the metal float, rotates the float to provide continuity of bonding contact. Bonding to the structure is completed through the mounting bracket.

A flanged stowage latch, with a screwdriver slot, is secured to the lower end of the calibrated tube and locks behind the outer assembly. When the stowage latch has been turned through 90 deg, the calibrated tube is partially ejected by the spring-loaded contents register. The tube is then withdrawn gently until the fields of the magnets link, when the calibration marking, indicating the fuel level in the tank, can be read off against the lower edge of the contents register. The measurement is then converted to tank capacity by reference to conversion tables (Ref. Fig.007 and 008).



R - Magnetic Level Indicator
Figure 006

MLI READING	TANK 5 kg	TANK 6 kg	TANK 7 kg	TANK 8 kg	TANK 9 FWD. kg	TANK 9 AFT kg
0	715	1145*	715*	1275		1075*
20	850	2125	1275	1625*		2335
40	1040*	2500	1690	2240		2615
60	1220	2775	2015	2650		2890
80	1440	3110	2350	2930	5050	3180
100	1720	3440	2685	3240	5400	3475
120	2010	3890	3005	3560	5775	3800
140	2300	4340	3335	3910	6145	4110
160	2575	4795	3655	4320	6505	4450
180	2850	5225	3990	4730	6900	4790
200	3100	5640	4300	5125	7265	5140
220	3350	6050	4590	5510	7620	
240	3610	6475	4880	5915	7990	
260	3860	6880	5160	6300	8360	
280	4130	7360	5450	6700	8700	
300	4370	7775	5733	7065	9000	
320	4610	8170	5985	7430	9300	
340	4845	8580	6225	7790	9590	
360	5075	8960	6450	8125	9860	
380	5300	9350	6670*	8475	10130*	
400	5510	9720	6875	8820	10380	
420	5725	10050	7065	9150	10615	
440	5915	10375*		9510		
460	6100	10660		9860		
480	6280	10940		10190		
500	6450*	11200		10510		
520	6620	11440		10815		
540	6790			11130		
560	6960			11420		
580	7140			11710*		
600				11985		
620				12235		
640				12490		
66C						
680						

NOTE: AIRCRAFT ATTITUDE INDICATOR READING = E6
FUEL SPECIFIC GRAVITY = 0.79

* = 15% AND 90% TANK LEVELS

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MLI Conversion Table 1
Figure 007

MLI READING	TANK 10 kg	TANK 11 kg
0	0	0
20	75	50
40	150	120
60	230	180
80	325	250
100	420	320
120	510	390
140	625	460
160	740	540
180	860	610
200	1000	680
220	1140	760
240	1285	840
260	1450	920
280	1625	1010
300	1820*	1090
320	2010	1180
340	2210	1275
360	2460	1360
380	2715	1460
400	3000	1550*
420	3290	1640
440	3610	1730
460	3940	1825
480	4300	1930
500	4695	2025
520	5050	2140
540	5415	2250
560	5733	2360
580	6120	2480
600	6470	2590
620	6820	2700
640	7180	2820
660	7520	2940
680	7870	3050
700	8200	3180
720	8520	3300
740	8760	3420
760	9220	3540
780	9540	3670
800	9870	3790
820	10190	3910
840	10520	4010
860	10880*	4150
880	11240	4280

NOTE:

AIRCRAFT ATTITUDE INDICATOR READING = E6

FUEL SPECIFIC GRAVITY = 0.79

* = 15% AND 90% TANK LEVELS

MLI READING	TANK 11 kg
900	4410
DEAD BAND	- -
1020	5170
1040	5300
1060	5425
1080	5550
1100	5680
1120	5820
1140	5950
1160	6080
1180	6210
1200	6340
1220	6475
1240	6600
1260	6720
1280	6850
1300	6980
1320	7110
1340	7225
1360	7340
1380	7475
1400	7580
1420	7710
1440	7825
1460	7940
1480	8030
1500	8170
1520	8270
1540	8380
1560	8500
1580	8620
1600	8720
1620	8820
1640	8920
1660	9030
1680	9125
1700	9225
1720	9320
1740	9420
1760	9520*
1780	9620
1800	9700
1820	9780
1840	9860
1860	9950
1880	10033

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MLI Conversion Table 2
Figure 008

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TANK FUEL LOAD kg	SPECIFIC GRAVITY						
	0.76	0.77	0.78	0.79	0.80	0.81	0.82
	SPECIFIC GRAVITY CORRECTION FACTOR (kg)						
1500	-50	-50	0	0	0	+50	+50
2000	-100	-50	-50	0	+50	+50	+100
2500	-100	-50	-50	0	+50	+50	+100
3000	-100	-100	-50	0	+50	+100	+100
3500	-150	-100	-50	0	+50	+100	+150
4000	-150	-100	-50	0	+50	+100	+150
4500	-150	-100	-50	0	+50	+100	+150
5000	-200	-150	-50	0	+50	+150	+200
5500	-200	-150	-50	0	+50	+150	+200
6000	-250	-150	-100	0	+100	+150	+250
6500	-250	-150	-100	0	+100	+150	+250
7000	-250	-200	-100	0	+100	+200	+250
7500	-300	-200	-100	0	+100	+200	+300
8000	-300	-200	-100	0	+100	+200	+300
8500	-300	-200	-100	0	+100	+200	+300
9000	-350	-250	-100	0	+100	+250	+350
9500	-350	-250	-100	0	+100	+250	+350
10000	-400	-250	-100	0	+100	+250	+400
10500	-400	-250	-150	0	+150	+250	+400
11000	-400	-300	-150	0	+150	+300	+400
11500	-450	-300	-150	0	+150	+300	+450
12000	-450	-300	-150	0	+150	+300	+450

FOR USE WITH MLI FUEL MEASUREMENT PROCEDURE

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Specific Gravity Correction Table
Figure 009

If necessary, the tank capacity figure obtained from the conversion table must be corrected for variations of fuel specific gravity by adding or subtracting the specific gravity correction factor (Ref. Fig. 009).

All the MLIs are similar, except for the indicator in tank 11, which is approximately 7 ft (2.134 m) in length and therefore has an added central support and buffer, with two floats, one above the central buffer and one below. This results in a small 'dead band' at approximately the mid-position where no fuel level reading can be obtained. If the MLI presents the 'dead band' the tube must be withdrawn further to engage the lower float. This will check whether the fuel level corresponds with, or is below, the MLI central support.

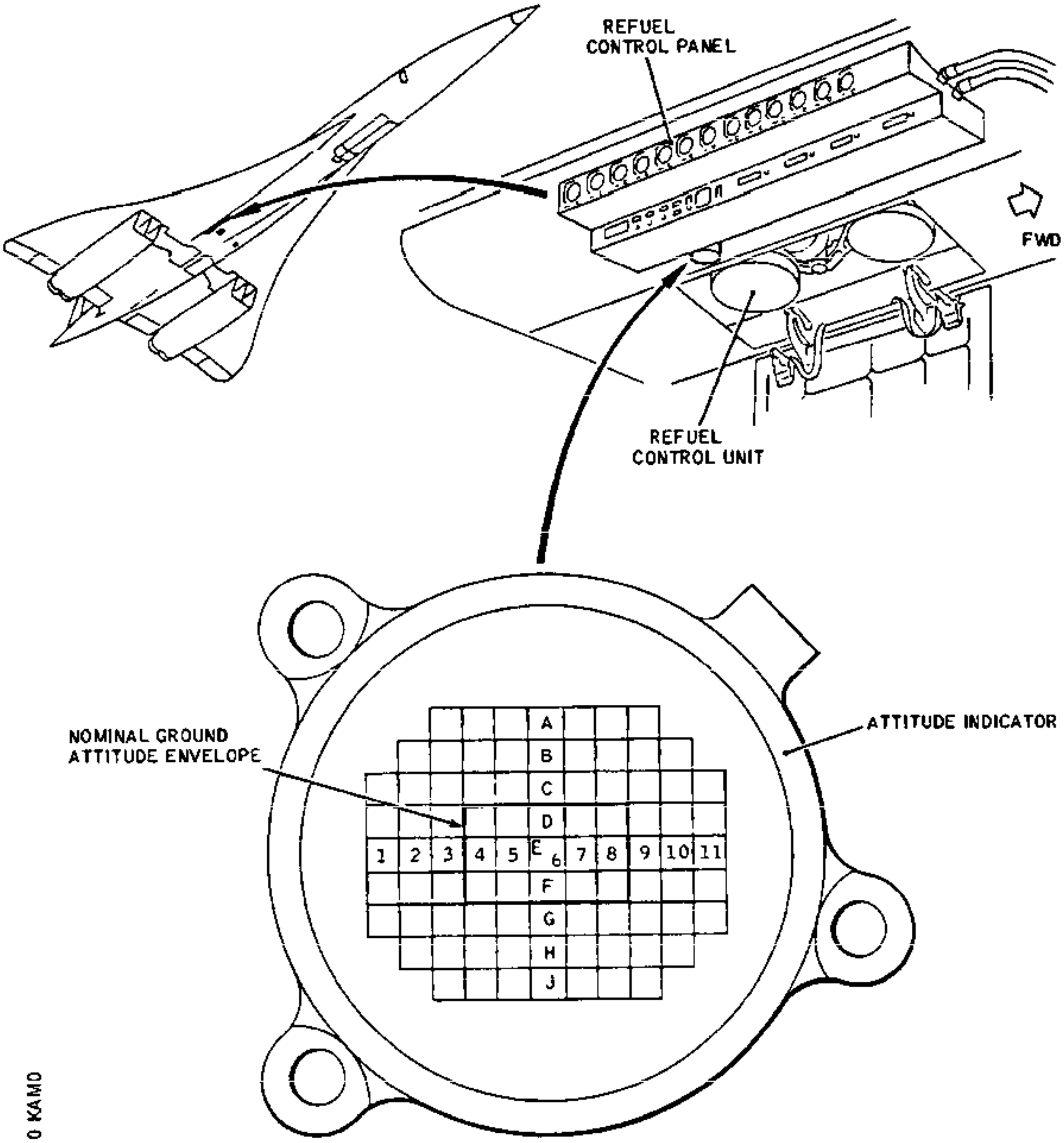
A single MLI in each of tanks 5, 6, 7, 8, 10 and 11 is sufficient to provide an accurate measurement of the tank fuel contents, but for tank 9 it is necessary to have a forward and rear MLI in each wing cell to achieve the required accuracy. The rear MLIs of tank 9 are used when the quantity of fuel in the tank is less than approximately 50 per cent, and the forward MLIs are used when the tank fuel quantity is more than 50 per cent. With the aircraft at 0 deg roll, only one forward or rear MLI requires checking in order to achieve the required accuracy. If the aircraft is not at 0 deg roll, both forward or rear MLIs are used and an average of the two readings is taken.

The pitch and roll ground attitude of the aircraft, which affects the accuracy of MLI readings, must be read on an aircraft attitude indicator (Ref. Fig. 010) before the MLIs are used.

The fuel quantity values given (Ref. Fig.007 and 008) are based on the nominal ground attitude with the bubble in the E6 graticule of the aircraft attitude indicator. Variations of up to 1 deg in the pitching sense should not give errors in fuel quantity greater than ±50 kg.

11. Aircraft Attitude Indicator (Ref. Fig. 010)

Indication of aircraft pitch and roll ground attitude is displayed continuously by the aircraft attitude indicator which uses the 'spirit level' principle and is mounted inboard of the refuel control panel in the right-hand wing lower fairing with the bubble visible from the underside. The indicator is used to determine whether the aircraft ground attitude is within the range necessary to achieve the required accuracy when measuring tank fuel quantity by means



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Aircraft Attitude Indicator
Figure 010

of the MLIs.

The indicator is horizontal when the bubble is in the E6 graticule, which corresponds to an aircraft attitude of 0 deg 55 min nose-up pitch and 0 deg roll. Each square of the grid represents 1/2 deg change in aircraft attitude and is identified alphabetically and numerically. The nominal ground attitude envelope (Ref. Fig. 010) indicates the area in which the bubble must appear to achieve the required high level fuel shut-off accuracy during refuelling.

TANKS - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

This topic comprises the procedures required to -

(1) prove a tank by pressurizing it with air following a structural repair (Ref. para.2.),

(2) locate the external leak area if the pressure in the tank is not maintained (Ref. paras.3. and 4.),

(3) trace an internal leak source within the tank when the external leak area is known, e.g., by visible
R fuel leakage (Ref. paras.5., 6. and 7.),

R (4) test a tank for acceptability (Ref. para.8.), and

(5) locate the external leak area for a Temporary Repair
R (Ref. para.9.).

The methods of testing involve the use of either freon gas equipment or a soap solution. The particular procedure to be adopted and equipment to be used must be determined by the safety factors involved and the tank area to be tested. Wherever possible, leak sources should be traced by using the local blowing technique (Ref. para.5.) in conjunction with the application of soap solution, thus avoiding the lengthy pressurization required for the other procedures. Whichever methods are used, acceptability of a tank must be confirmed through a final test with fuel in the system.

Operational, Functional and System Tests are not applicable to this topic.

R Pressurization of a tank with air or air/gas may be
R effected by providing connections either at probe apertures
R in the wing top surface, after removal of probes, or at a
R dummy tank panel, fitted in place of a normal access panel in
R the wing bottom surface. Both methods are given in these
R procedures.

R When preparing the tank for pressure testing, all vent
R apertures associated with the tank must be fitted with the

appropriate blanks, as listed for each tank in Tables 501 to 513. The blanks required in tank 11 are shown in the illustration (Ref. Fig. 502).

All air-no-fuel valves and vent drain valves that are removed for pressure testing are mounted on either common or individual secondary vent pipe elbows. In all cases, the elbow must be removed complete with the attached valves and the appropriate blank fitted at the elbow connection to the secondary vent piping.

Before entry into a tank for the purpose of tracing a leak source, reference should be made to the illustrations (where applicable) for details of complex structural areas (Ref. Approved Repairs).

2. Tank Pressure Test (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel drain tool, for operating tank water drain valve	D925374000
Air supply rig, capable of producing a pressure of 100 psig (6.89 bar)	-
Manometer, to measure pressure up to 5 psig (0.345 bar)	-
For pressurization via probe apertures:	
Pressure reducing valve, for all tanks except 5A, 7A and 11	E925135001
Pressure reducing valve, for tank 5A or 7A	E925135002
Pressure reducing valve, for tank 11	E925135003
Pressure relief valve (set to relieve pressure above 4 psig (0.276 bar)), for all tanks except 5A, 7A and 11	E925136001

DESCRIPTION	PART NO.
Pressure relief valve (set to relieve pressure above 4 psig (0.276 bar)), for tank 5A or 7A	E925136002
Pressure relief valve (set to relieve pressure above 4 psig (0.276 bar)), for tank 11	E925136003
For pressurization via tank dummy panel:	
Tank dummy panel, fitted with pressure reducing valve and pressure relief valve (set to relieve pressure above 4 psig (0.276 bar)), for all tanks except 5A, 7A and 11	D921681000
Tank dummy panel, for tank 5A	D921682000
Tank dummy panel, for tank 7A	D921682001
Tank dummy panel, for tank 11	D921683000
Blanks, for pressure testing the tank (Ref. Tables 501 to 513)	-

NOTE: The following Tables 501 to 513 are provided to give details of the blanks required, and their application, for pressure testing the individual tanks.

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 1	Blank, secondary valve drain	E925108000	Air-no fuel valve elbow connection
Tank 1	Blank, bursting disc	E925120000	To replace bursting disc
Tank 1	Blank, Gamah	E925100014	Secondary vent pipe, after removal of rear section of pipe complete with vent drain valve
Tank 1	Adapter, thermal expansion non-return valve	E925102000	To replace thermal expansion non-return valve
Tank 5, top of wing	Dummy element (qty. 2)	E925114000	To replace transfer control valves 5-1 (inboard, forward) and 6-1 (outboard)

Tank 1 Test Blanks
Table 501

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 2	Blank, secondary valve drain	E925108000	Air-no-fuel valve elbow connection
Tank 2	Blank, bursting disc	E925120000	To replace bursting disc
Tank 2	Blank, Gamah	E925100014	Secondary vent pipe, after removal of rear section of pipe complete with vent drain valve
Tank 2, top of wing	Dummy element	E925114000	To replace transfer control valve 6-2
Tank 5, top of wing	Dummy element	E925114000	To replace transfer control valve 5-2 (inboard, aft)

LOCATION	DESCRIPTION	PART NO.	APPLICATION

Tank 2 Test Blanks
Table 502

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 3	Blank, secondary valve drain	E925108000	Air-no-fuel valve elbow connection
Tank 3	Blank, bursting disc	E925120000	To replace bursting disc
Tank 3	Blank, Gamah	E925100014	Secondary vent pipe, after removal of rear section of pipe complete with vent drain valve
Tank 3	Adapter, thermal expansion non-return valve	E925102000	To replace thermal expansion non-return valve
Tank 7, top of wing	Dummy element	E925114000	To replace transfer control valve 7-3
Tank 8, top of wing cell	Dummy element	E925114000	To replace transfer control valve 8-3 (inboard, aft)

Tank 3 Test Blanks
Table 503

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 4	Blank, secondary valve drain	E925108000	Air-no-fuel valve elbow connection
Tank 4	Blank, bursting disc	E925120000	To replace bursting disc

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 4	Blank, Gamah	E925100014	Secondary vent pipe, after removal of rear section of pipe complete with vent drain valve
Tank 8 top of wing cell	Dummy element (qty. 2)	E925114000	To replace transfer control valves 7-4 (outboard) and 8-4 (inboard, forward)

Tank 4 Test Blanks
Table 504

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 5	Blank, secondary valve drain (qty. 2)	E925108000	Air-no-fuel and vent drain valve elbow connection
			Air-no-fuel valve elbow connection
Tank 5	Blank, bursting disc	E925121000	To replace bursting disc
Tank 5	Blank, tank pressure relief valve (qty. 2)	E925105000	To replace tank pressure relief valves (2)
Tank 5, top of wing	Dummy element (qty. 2)	E925114000	To replace inboard transfer control valves 5-1 and 5-2

Tank 5 Test Blanks
Table 505

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 6, wing cell	Blank, secondary valve drain (qty. 3)	E925108000	Air-no-fuel valve elbow connections (2) Air-no-fuel and vent drain valve elbow connection (1)
Tank 6, wing cell	Blank, bursting disc	E925121000	To replace bursting disc
Tank 6, wing cell	Blank, Gamah	E925100010	Thermal expansion pipe, after removal of pipe end section
Tank 6, wing cell	Blank, tank pressure relief valve (qty. 2)	E925105000	To replace tank pressure relief valves (2)
Tank 3	Blank, secondary valve drain	E925108000	Air-no-fuel and vent drain valve elbow connection in vent box
Tank 2, top of wing	Dummy element	E925114000	To replace transfer control valve 6-2
Tank 5, top of wing	Dummy element	E925114000	To replace outboard transfer control valve 6-1

Tank 6 Test Blanks
Table 506

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 7	Blank, secondary valve drain (qty. 4)	E925108000	Air-no-fuel valve elbow connections (2) Air-no-fuel and vent drain valve elbow connections (2)

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 7	Blank, bursting disc	E925121000	To replace bursting disc
Tank 7	Blank, tank pressure relief valve (qty. 2)	E925105000	To replace tank pressure relief valves (2)
Tank 7, top of wing	Dummy element	E925114000	To replace transfer control valve 7-3
Tank 8, top of wing cell	Dummy element	E925114000	To replace outboard transfer control valve 7-4

Tank 7 Test Blanks
Table 507

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 8, wing cell	Blank, secondary valve drain	E925108000	Air-no-fuel and vent drain valve elbow connection
Tank 8, wing cell	Blank, bursting disc	E925121000	To replace bursting disc
Tank 8, top of wing cell	Dummy element (qty. 2)	E925114000	To replace inboard transfer control valves 8-3 and 8-4
Tank 8, wing cell	Blank, Gamah	E925110010	Thermal expansion pipe, after removal of pipe end section
Tank 1	Blank, secondary valve drain	E925108000	Air-no-fuel valve elbow connection in vent box
Tank 1	Blank, tank pressure relief	E925105000	To replace tank pressure relief valve in vent box

LOCATION	DESCRIPTION	PART NO.	APPLICATION
	valve		
Tank 4	Blank, secondary valve drain	E925108000	Air-no-fuel valve elbow connection in vent box
Tank 4	Blank, tank pressure relief valve	E925105000	To replace tank pressure relief valve in vent box
Tank 5	Blank, secondary valve drain	E925108000	Air-no-fuel and vent drain valve elbow connection in vent box

Tank 8 Test Blanks
Table 508

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 9, LH and RH cells	Blank, secondary valve drain (qty. 6)	E925108000	Air-no-fuel valve elbow connections (2 LH and 2 RH)
			Air-no-fuel and vent drain valve elbow connections (1 LH and 1 RH)
Tank 9, LH and RH cells	Blank, tank pressure relief valve (qty. 3)	E925105000	To replace tank pressure relief valves (1 LH and 2 RH)
Tank 9, bottom of centre cell	Slave element (qty. 2)	E925104000	To replace pump elements

Tank 9 Test Blanks
Table 509

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LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 10, LH and RH cells	Blank, secondary valve drain (qty. 4)	E925108000	Air-no-fuel and vent drain valve elbow connections (1 LH and 1 RH)
			Air-no-fuel valve elbow connections (1 LH and 1 RH)
Tank 10, RH cell	Blank, bursting disc	E925121000	To replace bursting disc
Tank 10, LH and RH cells	Blank, tank pressure relief valve (qty. 3)	E925105000	To replace tank pressure relief valves (2 LH and 1 RH)
Tank 10, bottom of centre cell	Slave element (qty. 2)	E925104000	To replace pump elements

Tank 10 Test Blanks
Table 510

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 11	Blank, pressure test	E925075000	End of swan-necked vent pipe in tank
Tank 11	Sealing pegs	E925129000	Six holes in flanged sleeve of vent pipe in tank top
Tank 11	Blank, Gamah	E925100010	De-aeration pipe connection to forward electric pump
Tank 11, bottom of tank	Dummy element and plug adapter (qty. 2)	E925116001	To replace electric pump elements
Zone 153,	Blank, pump	E925106000	To replace hydraulic

LOCATION	DESCRIPTION	PART NO.	APPLICATION
frame 81	(qty. 2)		pipe elements
Top of fin	Air intake plug	E935055000	Tank pressurization pipe air intake

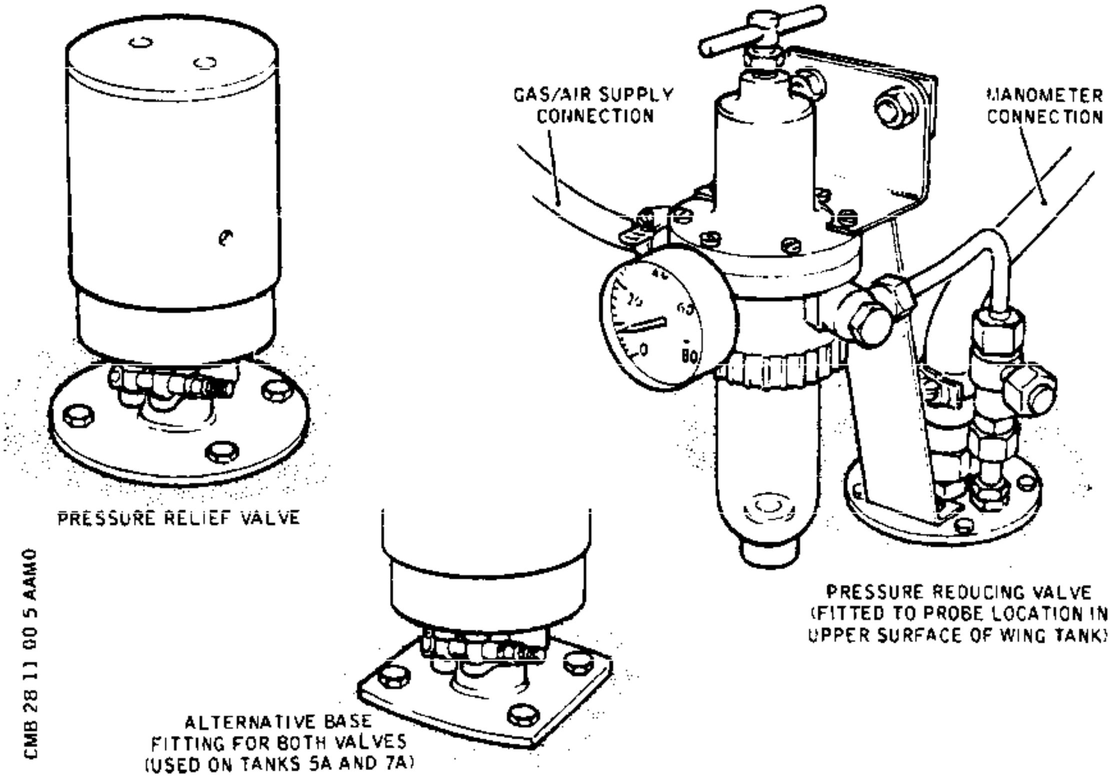
Tank 11 Test Blanks (Ref. Fig.502)
Table 511

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 5A	Blank, secondary valve drain	E925108000	Air-no-fuel and vent drain valve elbow connection
Tank 6, wing cell	Blank, vent box	E925133000	Vent drain valve and tank pressure relief valve elbow connection to vent box wall

Tank 5A Test Blanks
Table 512

LOCATION	DESCRIPTION	PART NO.	APPLICATION
Tank 7A	Blank, secondary valve drain	E925108000	Air-no-fuel and vent drain valve elbow connection
Tank 7	Blank, vent box	E925133000	Vent drain valve and tank pressure relief valve elbow connection to vent box wall

Tank 7A Test Blanks
Table 513



- Installation of Test Equipment -
Pressure Reducing and Pressure Relief Valves
Figure 501

B. Prepare to Test Tank

(1) Defuel and drain the tank under test (Ref. 28-25-00, Servicing).

(2) Defuel (Ref. 28-25-00, Servicing) the associated tanks (Ref. Tables 501 to 513) sufficiently to gain access to components.

R (3) At the refuel control panel, ensure, by reference
R to the magnetic indicators, that all the refuel
R valves are shut.

R (4) Ensure that all fuel management panel switches are
R at their normal ground settings (Ref. 28-00-00,
R Servicing).

R (5) At the fuel management panel, ensure, by reference
R to the magnetic indicators, that the following
R valves are shut:-

R (a) Collector tank jettison valves.

R (b) Cross-feed valves.

R (c) Trim inlet valves.

R (d) Interconnect valves.

R (e) Transfer shut-off valves.

R (6) For testing tank 1, 2, 3 or 4, set the appropriate LP VALVE switch to "SHUT 1" and check that the magnetic indicator displays bar-across-line.

R (7) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing, and disconnect the battery leads (Ref. 24-31-11).

R WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

R (8) Remove the appropriate tank access panels and prepare the tank for entry (Ref. 28-10-00, Servicing).

R (9) Remove components and fit the blanks, as listed in the appropriate Table (Ref. Tables 501 to 513); for component removal, refer to the following Removal/ Installation procedures, where applicable:-

R Air-no-fuel and vent drain valves (Ref. 28-12-12)

R Bursting disc (Ref. 28-12-16)

R Thermal expansion non-return valve (Ref. 28-12-14)

R Tank pressure relief valve (Ref. 28-12-11)

R Transfer control valve (Ref. 28-22-12)

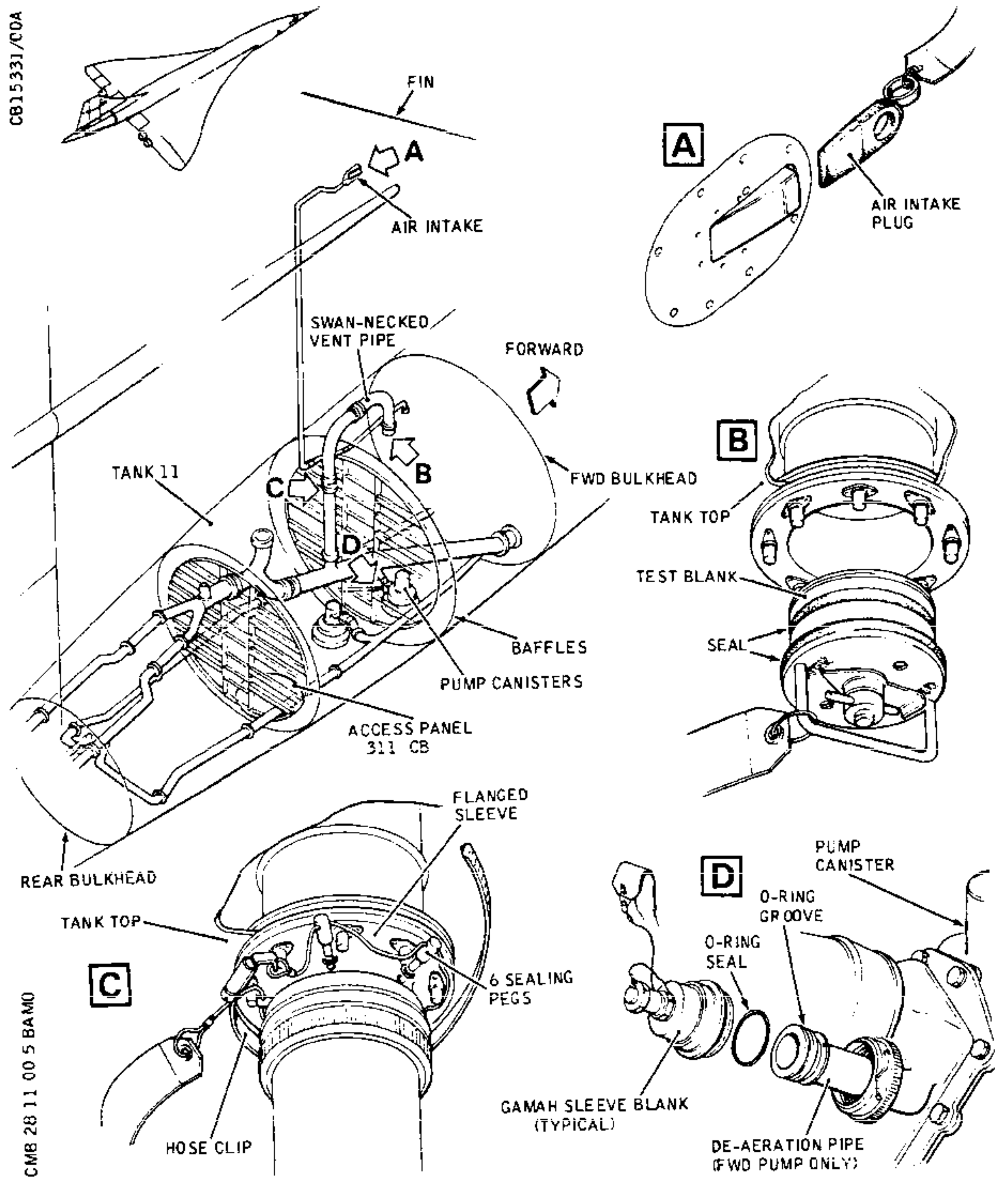
R Pump unit (electrical) tanks 9 and 10 (Ref. 28-23-31)

R Pump unit (hydraulic) tank 11 (Ref. 28-23-51)

R Pump unit (electrical) tank 11 (Ref. 28-23-53)

R (10) If tank 11 is under test, refer also to the illustration (Ref. Fig. 502) for the location and installation of test blanks.

R (11) Fit the valves required for the test, using either of the following methods, first ensuring that the



\- Tank 11 Test Blanks - Installation
Figure 502

R

relief valve is set to relieve pressure at 4 psig (0.276 bar):-

(a) Remove two probe units from the tank under test as detailed in the appropriate subject of section 28-44-. In place of the probe units, fit the appropriate pressure reducing valve and pressure relief valve, or

(b) fit the appropriate tank dummy panel and its attaching valves, as follows:-

<u>NOTE</u>: The tank dummy panel for all tanks except 5A, 7A and 11 is already fitted with a pressure relief valve and pressure reducing valve. If tank 5A, 7A or 11 is under test, these valves must be removed and fitted to the appropriate tank dummy panel as detailed in paragraphs b1), b2) and b3). If the test is not applicable to one of these tanks, proceed to paragraph b4).

b1) Fit a new toroidal seal, lubricated in accordance with 20-23-11, between the mating faces of the pressure relief valve and its mounting on the dummy panel; fit the clamp to secure the valve to its mounting.

b2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the pressure reducing valve and carefully position the valve in the underside of the dummy panel, ensuring that the O-ring seal is not displaced.

b3) Secure the pressure reducing valve to the dummy panel with the four bolts, washers and nuts, inserting the bolts firstly through the valve flange and then through the dummy panel. Ensure that the sealing washers beneath the bolt-heads, and the seal between the mating faces of the valve and dummy panel, are clean and undamaged. Tighten the nuts sufficiently to ensure a leak-free joint.

b4) Position the dummy panel inside the tank with the seal positioned between the mating faces of the panel and tank. Position the

clamp on the outside skin and tighten the captive bolts sufficiently to ensure a leak-free joint.

(12) Connect the air supply pipe and water manometer to the pressure reducing valve adapter (Ref. Fig. 501).

(13) Refit all access panels (except where a dummy panel is fitted) in accordance with 53-00-00 or 57-00-00, Removal/Installation, as applicable.

C. Test Tank

(1) Pressurize the tank to 4 psig (0.276 bar). After approximately 10 min, check the tank pressure and if necessary readjust to 4 psig (0.276 bar).

<u>NOTE</u>: A small increase or decrease in tank pressure is likely to occur after initial pressurization due to expansion or contraction of pressurizing air in contact with tank surfaces.

(2) Allow approximately 1 h to elapse and then check if the 4 psig (0.276 bar) tank pressure has been maintained. If a pressure drop is indicated, release the tank pressure and, using one or more of the following procedures (Ref. paras.3., 4., 5., 6. and 7.), locate and trace the leak source.

D. Conclusion

(1) Release the air pressure in the tank.

(2) Disconnect the air supply pipe and manometer from the pressure reducing valve adapter.

(3) Remove the dummy panel, if fitted to the tank.

(4) Remove the pressure reducing valve and pressure relief valve (Ref. Fig. 501) if fitted to the tank probe positions and refit the probe units (Ref. 28-44-, Removal/Installation).

(5) Remove the access panels and remove all the blanks previously fitted.

(6) Install components previously removed, as detailed in the appropriate Removal/Installation procedures:-

Air-no-fuel and vent drain valves (Ref. 28-12-12)

Bursting disc (Ref. 28-12-16)

Thermal expansion non-return valve (Ref. 28-12-14)

Tank pressure relief valve (Ref. 28-12-11)

Transfer control valve (Ref. 28-22-12)

Pump unit (electrical), tanks 9 and 10 (Ref. 28-23-31)

Pump unit (hydraulic), tank 11 (Ref. 28-23-51)

Pump unit (electrical), tank 11 (Ref. 28-23-53)

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(7) Tank 1, 2, 3 or 4: refit the end section of the secondary vent pipe.

(8) Tank 6 or 8: refit the end section of the thermal expansion pipe.

(9) Tank 11: refit the de-aeration pipe to the forward electric pump and carry out a Functional Test and a Leakage Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

R (10) Prior to tank close-up visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (11) Refit all access panels, as detailed in 53-00-00 or 57-00-00, Removal/Installation, as applicable.

R (12) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

3. Leak-locating, by Pressurizing the Tank

A. Equipment and Materials

DESCRIPTION	PART NO.
Soap solution:	
Recommended:	
TURCO BUBBLE FLUID	-
Approved alternatives:	
SNOOP (Ref. 20-30-00, No.195)	-
SHERLOCK (Ref. 20-30-00, No.196)	-
Brush, for application of soap solution	-

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B. Prepare to Locate Leak

(1) Prepare the tank as for pressure testing (Ref. para.2.), with the exception of removing the thermal expansion non-return valve in tank 1 or 3.

C. Locate Leak, by Pressurizing Tank

(1) Connect an air supply and manometer to the pressure reducing valve fitted to the tank (Ref. Fig. 501).

(2) Pressurize the tank to 4 psig (0.276 bar) and then close the air supply.

(3) Apply an approved soap solution to suspected areas of the external surface of the tank.

(4) Check the surface, especially at seams, panels and fasteners, for foam or bubble formations indicating leaks.

(5) Extend the test to all areas of the tank and, after wiping the surface free of the soap solution, mark the leak areas with a non-indelible marking.

D. Conclusion

(1) If the internal leak source is established, carry out the repair as necessary (Ref. Approved Repairs). If the leak source is not established, trace the leak by local blowing (Ref. para.5.).

(2) Carry out the Tank Acceptance Test (Ref. para.8.).

4. Leak-locating, using Gas Detector (Ref. Fig. 503)

A. Equipment and Materials

DESCRIPTION	PART NO.
Gas detector	-
Freon gas/air supply rig (for use with gas detector)	-
Soap solution (Ref. para.3.)	-
Brush, for application of soap solution	-

B. Prepare to Locate Leak

(1) Prepare the tank as for pressure testing (Ref. para.2), with the exception of removing the thermal expansion non-return valve in tank 1 or 3.

C. Locate Leak, using Gas Detector

WARNING: THE GAS DETECTOR MAY INCORPORATE A DETECTOR GUN WHICH HAS A HOT-RUNNING SENSING ELEMENT WITH AN OPERATING TEMPERATURE OF 800 deg C. THIS TYPE OF GUN MUST NOT BE USED IN THE PRESENCE OF FLAMMABLE VAPOURS.

PRIOR TO TESTING, THE AIRCRAFT MUST BE COMPLETELY DEFUELLED AND THE INTERIOR OF THE TANK TO BE TESTED AND ITS SURROUNDING STRUCTURE DRIED AND THOROUGHLY VENTILATED, TO ENSURE A VAPOUR-FREE ATMOSPHERE INSIDE THE TANK AND WITHIN THE TEST AREA.

(1) Connect the gas supply rig and manometer to the pressure reducing valve fitted to the tank (Ref. Fig. 503).

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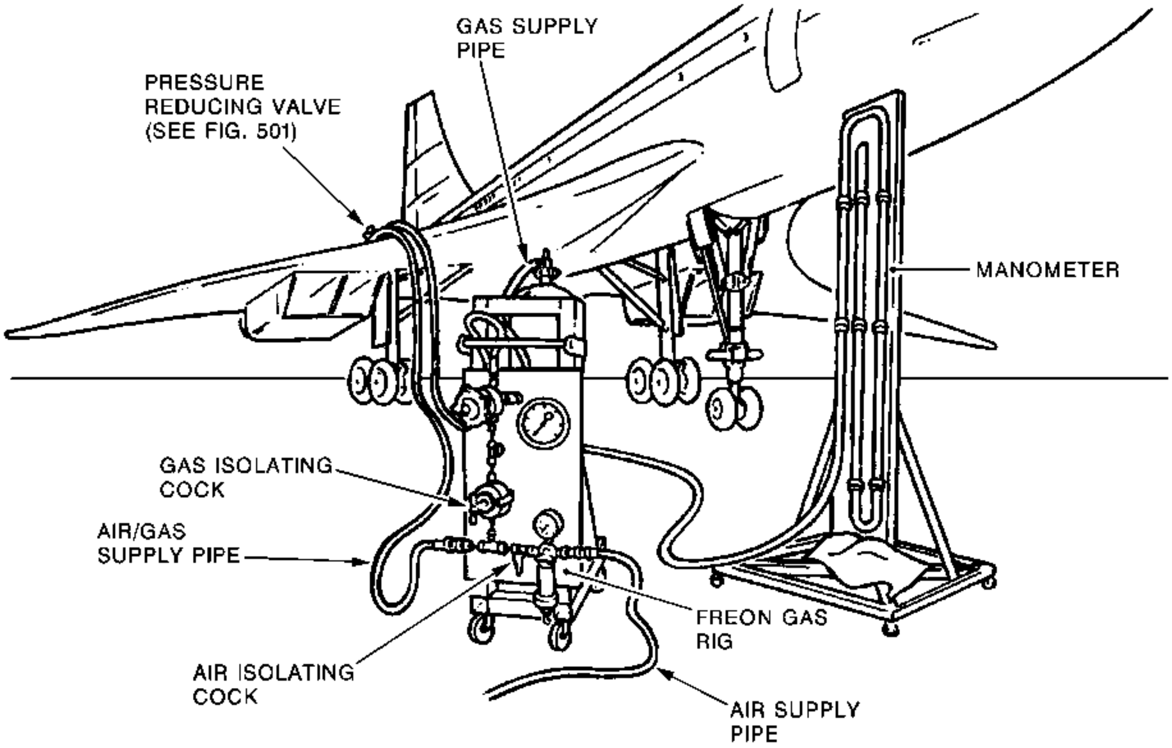

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Fuel Tank Pressurization - Air/Freon Gas
Figure 503

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(2) Operate the rig to pressurize the tank with gas to between 0.15 psig (0.0103 bar) and 0.30 psig (0.0206 bar), then close the supply cock.

(3) Connect an air supply to the junction connector on the supply rig and operate the rig to deliver the air supply and increase the tank pressure to 4 psig (0.276 bar), then close the supply cock.

(4) Position the detector console in the area to be tested.

(5) Operate the detector gun in accordance with the manufacturer's instructions.

(6) Monitor the exterior structure of the tank, holding the detector gun close to suspect areas such as seams, panels and fasteners.

(7) Locate the leak area by application of an approved soap solution.

(8) Mark the leak area with a non-indelible marking.

D. Conclusion

(1) Release the pressure and disconnect the air/gas supply rig.

<u>WARNING</u>: WHEN FREON GAS HAS BEEN USED IN TESTS, THE TANK MUST BE PURGED WITH CLEAN AIR FOR 2 h BEFORE PERSONNEL ARE PERMITTED TO ENTER THE TANK.

(2) If the internal leak source is established, carry out the repair as necessary (Ref. Approved Repairs). If the leak source is not established, trace the leak by local blowing (Ref. para.5.).

(3) Carry out the Tank Acceptance Test (Ref. para.8.).

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5. Leak-tracing, by Local Blowing

A. Equipment and Materials

DESCRIPTION	PART NO.
Whitening solution:	
French chalk and methylated spirit, mixed to a thin paint consistency, or	-
Ardrox flaw detector	-
Soft crayon or adhesive tape	-
Air supply, at normal workshop air-line pressure	-
Fish-tailed adapter	-
Soap solution (Ref. para.3.)	-
Brush, for application of soap solution	-
RB Eurotwill cloth	-

B. Prepare to Trace Leak

WARNING: OBSERVE THE FUEL LOAD CG LIMITATIONS DETAILED IN 28-25-00, SERVICING, 'DEFUELLING LIMITATIONS'.

(1) Refuel to high level capacity (Ref. 12-11-28) the tank suspected of leaking.

(2) Remove wing leading edge and wing fillet fairings if applicable (Ref. Inspection/Check).

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C. Trace Leak, by Local Blowing

(1) Wipe the suspected area(s) dry with a clean cloth and apply a whitening solution.

(2) Mark the external position of a leak, using a soft crayon or adhesive tape, and determine the source of the leak (i.e., establish whether from an attachment, a bolted or riveted skin joint, an access panel etc., or whether resulting from joint or structural damage).

NOTE: If the leak is due to structural damage, reference must be made to the Structural Repair Manual.

(3) Defuel and drain (Ref. 28-25-00, Servicing) the suspected tank and prepare the tank for entry (Ref. 28-10-00, Servicing).

(4) Before entry into the tank refer to the illustrations (where applicable) for details of complex structural areas (Ref. Approved Repairs).

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(5) Determine the approximate location of the leak inside the tank and remove the sealing fillets and over-coating (Ref. Approved Repairs) from the suspected leak source.

(6) Establish the leak source as follows:

(a) Thoroughly clean and dry the internal suspected area
RB with clean Eurotwill cloth and apply an approved soap solution, by brush or other suitable applicator, over the area.

(b) Simultaneously apply a jet of dry, filtered air at normal workshop air-line pressure, using a fish-tailed adapter held close to the exterior of the tank at the leak point and the surrounding area, and check for air bubbles on the prepared inner surface of the tank.

(c) Mark the exact position of the leak and remove all faulty sealant where necessary (Ref. Approved Repairs).

(d) Remove all traces of the soap solution with a clean water-dampened cloth. Finally dry and clean the area.

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D. Conclusion

(1) Carry out the repair as necessary (Ref. Approved Repairs).

(2) Carry out the Tank Acceptance Test (Ref. para.8.).

6. Leak-tracing, Using Vacuum Method

WARNING: OPERATORS SUBJECTED TO NEGATIVE PRESSURE CONDITIONS ARE REQUIRED TO UNDERGO A PERIODIC MEDICAL EXAMINATION.

THE MAXIMUM WORKING TIME FOR AN OPERATOR SUBJECTED TO NEGATIVE PRESSURE CONDITIONS IS SUBJECT TO LOCAL HEALTH AND SAFETY REGULATIONS.

THE LIMIT OF NEGATIVE DIFFERENTIAL PRESSURE OF THE STRUCTURE IS -1.5 psig (0.103 bar), BUT LOCAL HEALTH AND SAFETY REGULATIONS MAY REQUIRE A LESSER VALUE TO BE USED.

CAUTION: ACCESS TO LEAK AREAS IN SOME TANKS MAY NECESSITATE REMOVAL OF THE BRACING STRUTS INSIDE THE TANK. NOT MORE THAN ONE STRUT PER RIB OR SPAR MAY BE REMOVED AND THIS MUST BE DONE BEFORE TANK INTERNAL PRESSURE IS REDUCED.

NOTE: This method of leak-tracing is used for leak areas where access may be gained only from within the tank. It requires the tank internal pressure to be reduced to below atmospheric and a check to be made for air leaks on the inside of the tank whilst the lower pressure is maintained. Approved breathing equipment and communications equipment are required for this procedure.

A. Equipment and Materials

DESCRIPTION	PART NO.
Dummy tank panel, wing zones:	
Tanks 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10	T87.25.E2.4074.001
Dummy tank panel, fuselage zones:	
Tanks 6, 8, 9 and 10	T87.25.E2.4074.002
Tank 11	E925138000
Breathing equipment	-

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DESCRIPTION	PART NO.
Communications equipment	-
Blanks, for pressure testing the tank (Ref. Tables 501 to 513, with the exception of pump dummy elements)	-
Vacuum equipment and controls capable of reducing the pressure of a volume of 600 cu ft (17 cu m) of air by 1.5 psig (0.103 bar) over a period of 10 min	-
Manometer, set to relieve negative pressure in excess of -1.5 psig (0.103 bar)	-
Explosion-proof lead lamp or torch	-
Soap solution, for leak detection:	
Recommended:	
TURCO BUBBLE FLUID	-
SNOOP (Ref. 20-30-00, No.195)	-
SHERLOCK (Ref. 20-30-00, No.196)	-
Brush, for application of soap solution	-
RB Eurotwill cloth	-
Soft crayon or adhesive tape, for marking leak area	-
Sealant removal tools (Ref. Approved Repairs)	

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B. Prepare to Trace Leak

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Prepare the tank as for pressure testing (Ref. para.2.), with the exception of fitting dummy elements in place of the pump elements.

(2) Connect the breathing equipment and communications equipment to the dummy tank panel. Check that both items of equipment are in correct working order.

(3) Fit the dummy panel to the aircraft.

(4) Connect the vacuum equipment and the manometer, set to relieve negative pressure in excess of -1.5 psig (0.103 bar), to the dummy panel and ensure that all valves are fitted and closed.

(5) Over a period of 10 min, gradually reduce the tank internal pressure to a maximum value of -1.5 psig (0.103 bar) below atmospheric pressure. Ensure that this pressure can be maintained and not exceeded without continual adjustment of the vacuum equipment controls.

(6) Release the vacuum and remove the dummy panel.

(7) Prepare a quantity of soap solution.

C. Trace Leak, using Vacuum Method

(1) Enter the tank (two operators), wearing breathing and communications equipment and taking soap solution, brush, fillet removal tools and equipment for marking and cleaning the leak area.

(2) Refit the dummy panel and ensure that all valves are fitted and closed.

(3) Check that all breathing and communications equipment is in correct working order.

WARNING: MONITORING OF THE VACUUM READING AND COMMUNICATION WITH THE OPERATORS MUST BE MAINTAINED THROUGHOUT THE TEST.

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(4) Over a period of 15 min, gradually reduce tank internal pressure to a maximum value of -1.5 psig (0.103 bar) below atmospheric pressure, or to such lesser value as permitted by local health and safety regulations, at the same time maintaining communication with the operators and keeping a close watch on the operation of the equipment and the vacuum reading.

(5) Inside the tank, at the suspected leak source area, apply the soap solution with the brush and watch for the appearance of bubbles.

(6) Mark the exact position of the leak(s) and remove all faulty sealant where necessary (Ref. Approved Repairs).

(7) Gradually relieve the negative pressure over a period of 15 min.

(8) Remove all traces of soap solution, using clean,
RB water-dampened, Eurotwill cloth. Finally dry and clean the area.

D. Conclusion

(1) Remove the dummy panel and associated equipment.

(2) Carry out the repair as necessary (Ref. Approved Repairs).

(3) Carry out the Tank Acceptance Test (Ref. para.8.).

7. Leak-tracing, by Pressurizing the Cabin (Ref. Fig. 504)

A. General

This procedure requires the cabin to be pressurized to 2.9 psig (200 mb). While this pressure is maintained, the position of fuel leaks, in certain areas, can be determined by entering the tanks and using soap solution as detailed in previous procedures. The areas inside the tanks to which this procedure applies are the surfaces below, or behind, the vapour seals, namely:

Tank 9: fuselage cell forward bulkhead, F38

Tank 9: fuselage cell upper surface, F38 to 41

Tank 10: fuselage cell upper surface, F41 to 46

Tank 8: fuselage cell upper surface, F46 to 54

Tank 6: fuselage cell upper surface, F60 to 66

Tank 11: forward bulkhead, F81

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To pressurize the cabin to 2.9 psig (200 mb), a suitable air supply is required, together with equipment to regulate the supply when the desired pressure is reached. The air supply is connected to the ground pressurizing connection, which allows cabin pressurization on the ground without operating the aircraft air conditioning system. This connection is located in the air conditioning compartment under the aft fuselage near frame 67. Two pressure connectors, located near the ground pressurizing connection, are provided to allow connection of test equipment for measurement and control of cabin pressure during tests on the ground.

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B. Aircraft Configuration for Cabin Pressurization

(1) The aircraft must be positioned with its wheels on the ground, thus compressing the main landing gear shock absorbers.

(2) There must be no one in the cabin during the test.

(3) All doors and panels of the pressure cabin must be closed and all equipment, access platforms etc., not required for the test procedure, must be removed from the vicinity of the aircraft.

(4) Access panels for the appropriate tanks must be removed and the tanks must be vented and prepared for entry as detailed in 28-10-00, Servicing.

C. Equipment and Materials

DESCRIPTION	PART NO.
Air supply equipment, capable of supplying dry, clean air at a pressure of 40 to 80 psig (2.758 to 5.516 bar)	-
Suitable ground test equipment installation (Ref. Fig. 504), comprising the following:	
Aircraft connector, for ground pressurizing connection	Normalair-Garret 1440A000
LP pipes	-
Flexible hoses (2), fitted with aircraft connectors (standard AN-type, 1/4 in (6.35 mm) dia.)	-
Manometer, 0 to 9 psi (0 to 0.6 bar)	-
Rate-of-change (vertical speed) indicator	-
Pressure gauge	-
Manifold, fitted with three air supply control valves	-
Filter, with fittings	-

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DESCRIPTION	PART NO.
Adapter, for connection of air supply to manifold	-
Soap solution (Ref. para.3.)	-
Brush, for application of soap solution	-
RB Eurotwill cloth	-
Sealant-removal tools (Ref. Approved Repairs)	-
Soft crayon or adhesive tape, for marking leak area	-
Explosion-proof lead lamp or torch	-

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D. Prepare to Trace Leak

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 501.

OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Open the air conditioning compartment access panel, 151 CB. Unscrew and remove the cap from the 3 in (76 mm) dia. ground pressurizing connection located on the compartment roof.

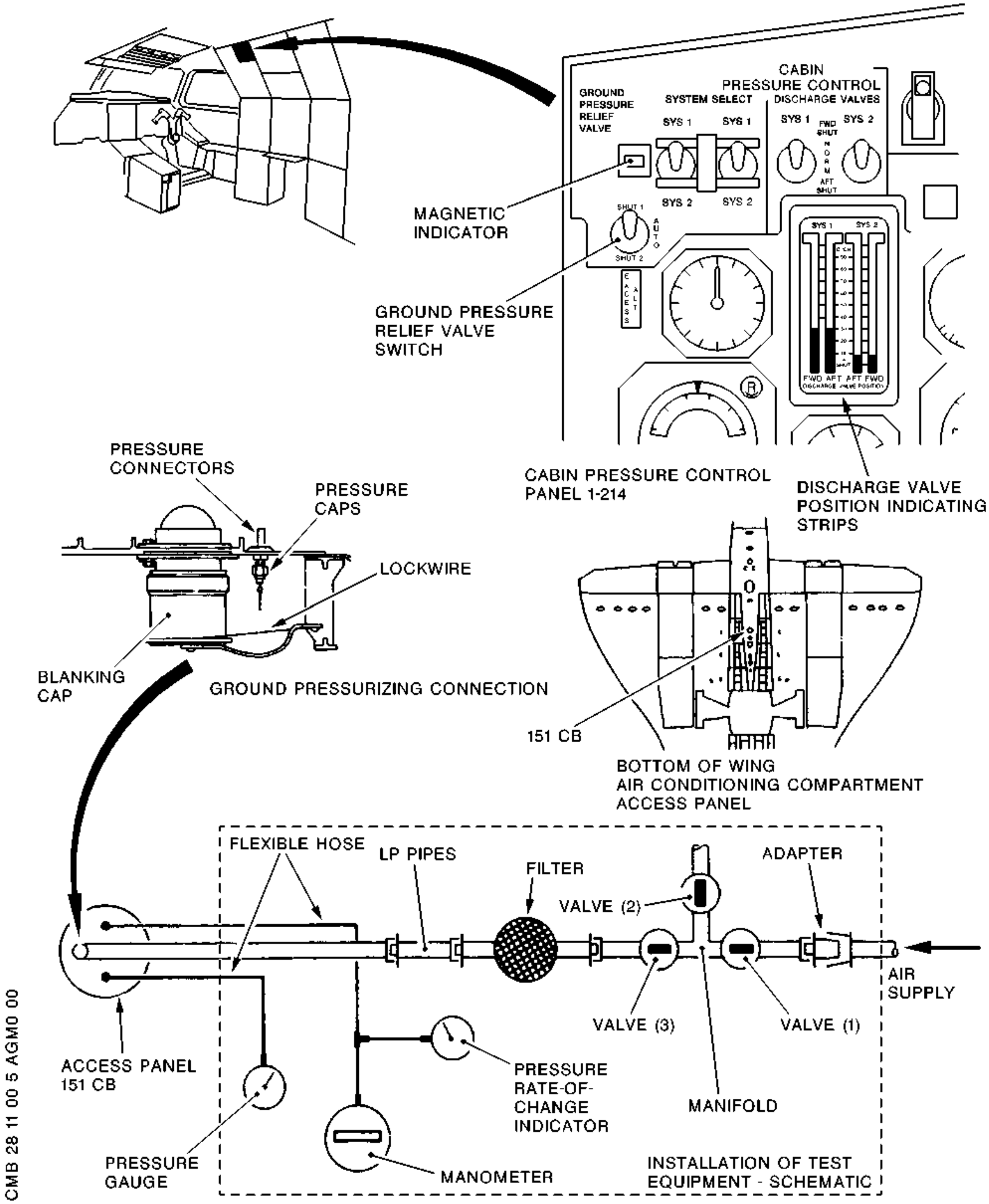
(2) Check that the non-return valve, within the connection, functions correctly, by fully opening both valve flaps and ensuring that, when slowly released, both valve flaps return to the closed position without sticking or binding.

(3) Connect the LP pipeline to the ground pressurizing connection, using the aircraft connector.

(4) Remove the pressure cap nuts from the two 1/4 in (6.35 mm) dia. pressure connectors near the ground pressurizing connection and connect the two flexible hoses.

(5) To the flexible hoses, fit the manometer, pressure gauge and rate-of-change (vertical speed) indicator, as illustrated (Ref. Fig. 504).

(6) Connect the air supply to the manifold and close valve (1).



Cabin Pressurization - Test Equipment,
Controls and Indicators
Figure 504

(7) Make available electrical ground power as detailed in 24-41-00, Servicing.

(8) At the cabin pressure control panel, 1-214 (third crew member's station), set the GROUND PRESSURE RELIEF VALVE switch to "SHUT 1" or "SHUT 2". Check that the associated magnetic indicator displays diagonal stripes and then SHUT.

(9) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

NOTE: On the ground, with electrical power on, the four cabin pressure regulating (discharge) valves are normally open. When electrical power is switched off, these valves will close and their position-indicating strips will show the 'power-off' position (SHUT).

(10) Fit the plugs to the four wash-basin drains.

(11) Fit a suitable blanking plug to the air pressurization hydraulic chassis vent valve orifice, forward of F9, LH side.

E. Trace Leak, by Pressurizing the Cabin

CAUTION: TO AVOID POSSIBLE DAMAGE TO AIRCRAFT INSTRUMENTS, THE CABIN PRESSURE MUST NOT EXCEED 2.9 psig (200 mb) AND THE PRESSURIZING RATE MUST NOT EXCEED 2,000 ft/min OR 1.2 mb/s.

(1) Before commencing the procedure, check that the air supply is clean and dry. Close valve (3) and open valve (1). Open valve (2) and place a cloth over the valve outlet, allowing the air to flow for 2 min. Check that the cloth is clean and dry.

(2) Close valve (2) and open valve (3).

(3) Commence pressurizing and ensure, by means of the control valves, that the pressurizing rate does not exceed 2,000 ft/min or 1.2 mb/s. Adjust the airflow to stabilize the pressure at 2.9 psig (200 mb).

(4) Monitor the flow rate and adjust it to balance the leaks during the test period.

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(5) Inside the tank, at the suspected leak source area, apply the soap solution with the brush and watch for the appearance of bubbles.

(6) Mark the exact position of the leak(s) and remove all faulty sealant where necessary (Ref. Approved Repairs).

(7) Remove all traces of soap solution, using clean, water-
RB dampened, Eurotwill cloth. Finally dry and clean the area.

F. Conclusion

(1) Shut off the air supply and release the pressure in the supply pipeline by opening valve (2) and closing valve (1).

NOTE: The pressure in the cabin will decay to ambient pressure after approximately 15 min.

(2) Disconnect the LP pipe from the ground pressurizing connection and refit the blanking cap.

(3) Disconnect the flexible hoses and refit the pressure cap nuts.

(4) Remove the ground test equipment.

(5) Close panel 151 CB.

(6) Remove the vent valve blanking plug, forward of F9.

(7) Remove the plugs from the wash-basin drains.

(8) Carry out tank sealing repair as necessary (Ref. Approved Repairs).

(9) Cancel the electrical safety precautions and remove the warning notices as detailed in 28-00-00, Servicing.

(10) Make available electrical ground power as detailed in 24-41-00, Servicing.

(11) At the cabin pressure control panel, 1-214 (third crew member's station), set the GROUND PRESSURE RELIEF VALVE switch to "AUTO". Check that the associated magnetic indicator displays OPEN.

(12) Carry out the Tank Acceptance Test (Ref. para.8.).

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(13) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

8. Tank Acceptance Test

NOTE: The Acceptance Test confirms that a tank will not leak when filled with fuel. However, since a leak disclosed at this stage will necessitate the draining and drying of the tank before it can be repaired, it is preferable that any leakage be detected earlier. Therefore, if the tank to be tested has already been prepared for a pressure test (Ref. para.2.), such a test should be carried out before the Acceptance Test.

A. Equipment and Materials

DESCRIPTION	PART NO.
Floodlamp	-
Lint-free tissues	-

B. Prepare

WARNING: OBSERVE THE FUEL LOAD CG LIMITATIONS DETAILED IN 28-25-00, SERVICING, 'DEFUELLING LIMITATIONS'.

(1) Thoroughly dry the tank externally.

(2) Refuel the tank to high level capacity (Ref. 12-11-28).

C. Test

(1) After a minimum of 4 h, direct a bright light on to the area under test and check that there is no leakage.

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9. Leak-locating, for Temporary Repair

A. Equipment and Materials

DESCRIPTION	PART NO.
Whitening solution:	
French chalk and methylated spirit, mixed to a thin paint consistency, or	-
Ardrox flaw detector	-
Soft crayon or adhesive tape	-

B. Prepare to Locate Leak

WARNING: OBSERVE THE FUEL LOAD CG LIMITATIONS DETAILED IN 28-25-00, SERVICING, 'DEFUELLING LIMITATIONS'.

(1) Refuel to high level capacity (Ref. 12-11-28) the tank suspected of leaking.

(2) Remove wing leading edge and wing fillet fairings, if applicable (Ref. Inspection/Check).

C. Locate Leak for Temporary Repair

(1) Wipe the suspected area(s) dry with a clean cloth and apply a whitening solution.

(2) Mark the external position of a leak, using a soft crayon or adhesive tape, and determine the source of the leak.

NOTE: If the leak is due to structural damage, reference must be made to the Structural Repair Manual.

D. Conclusion

(1) Carry out a temporary repair (Ref. Approved Repairs).

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B 10. Leak-locating using the Helium Technique

B A. Equipment and Materials

DESCRIPTION	PART NO.
Helium equipment including helium, detector and hose	969-4000 969-4100 969-4300
Plastic sheeting	CAPRAN524260TUBE
Aluminium tape	-
Vacuum tape	SM5127

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B B. Prepare to Locate Leak

B (1) Fully fuel the tank. Visually locate the leak exit point on the external surface of the aircraft and confirm the leak rate.

B (2) Defuel, drain and vent the tank as necessary.

B C. Trace Leak, using Helium Technique

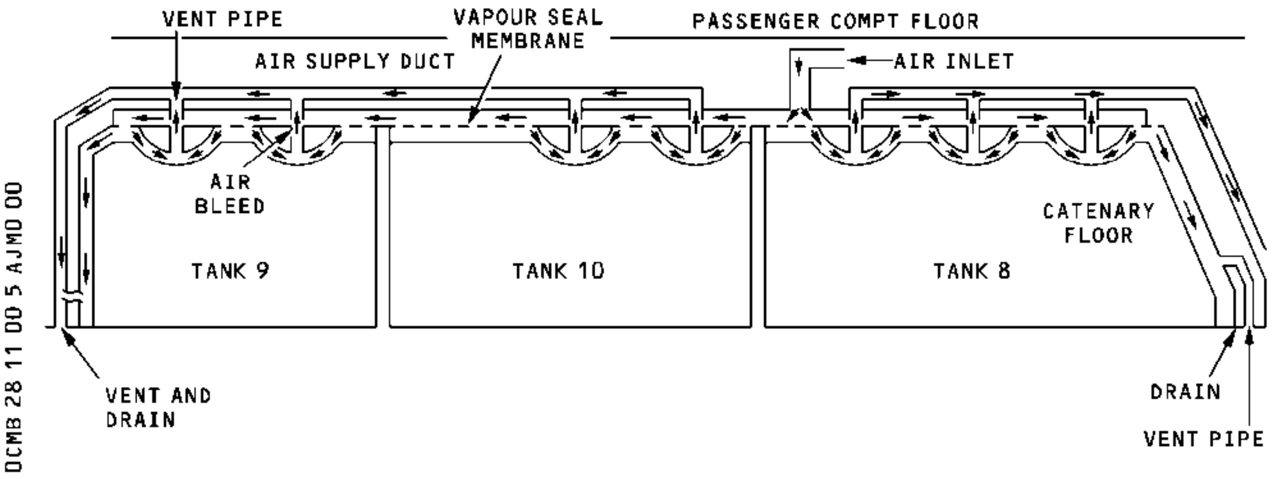
B WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

B (1) Enter the tank and clean the leaking area by degreasing and blowing air.

B (2) Fix an artificial helium chamber around the leak exit point by penetrating one corner of the plastic bag with the rubber hose from the helium supply and sealing the join with sealant and aluminium tape. Attach the open end of the plastic bag to the skin of the wing around the leak, also by aluminium tape.

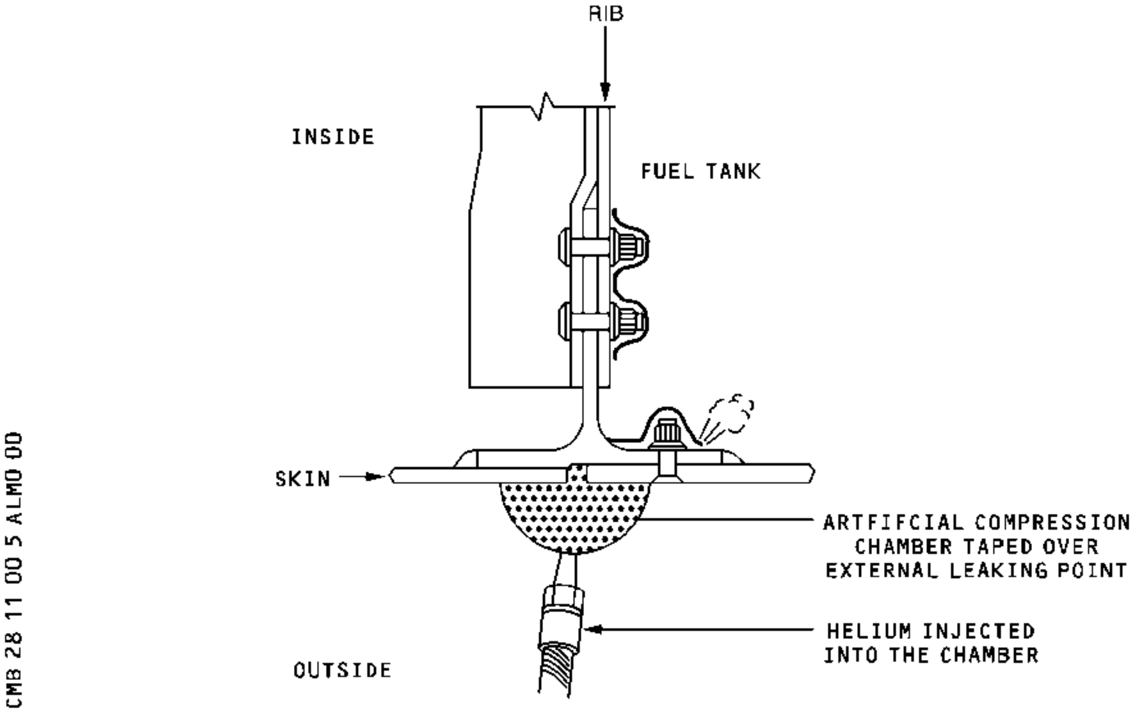
B NOTE: The design of the chamber is left to the ingenuity of the engineer to suit the local application.

B (3) If the nature of the leak means that the helium chamber cannot be created by the described method, a chamber must be created by some other means. Examples of adaptations include the creation of the chamber by use of the vapour seal, having firstly sealed off the vent (Ref. Fig.505).



NOTE: Diagram showing catenary tanks. Injection of helium gas via the vent enables leaks internally in the fuel tank to be detected. In addition leaks in the vapour seal may also be found.

B
B
Catenary Tanks
Figure 505



B
B
Helium Injection into Artificial Chamber
Figure 506

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CAUTION: THE CHOICE OF PRESSURE USED IN OPERATION (4) DEPENDS ON THE KIND OF LEAK (RATE, LOCATION) AND MUST BE BASED ON STRUCTURE KNOWLEDGE, POTENTIAL CHIMNEYS OR NOT.
OBSERVE A MAXIMUM PRESSURE OF 2.9 psig (200 mb).

(4) Inject helium into the chamber at a constant pressure (Ref. Fig.506).

(5) Vent the tank and maintain ventilation throughout the detection phase.

CAUTION: ENSURE ALL FUEL RESIDUES ARE DRAINED AS THE HELIUM DETECTION PROBE MAY BE DAMAGED IF IN CONTACT WITH LIQUID FUEL.

(6) Enter the tank and scrutinize the suspected area with the detector to accurately determine the leak source. It may be necessary to increase the injection pressure at this stage (Ref. Fig.507).

NOTE: More than one leak may exist in the same area. It may therefore be necessary to repeat this operation several times.

D. Conclusion

(1) Carry out repairs as necessary (Ref. Approved Repairs).

(2) The helium technique must be used to check the quality of the repair by placing the compression chamber over the repair and using the detector around the leaking point.

NOTE: This avoids re-fuelling, de-fuelling and venting the tank if the leak is not rectified.

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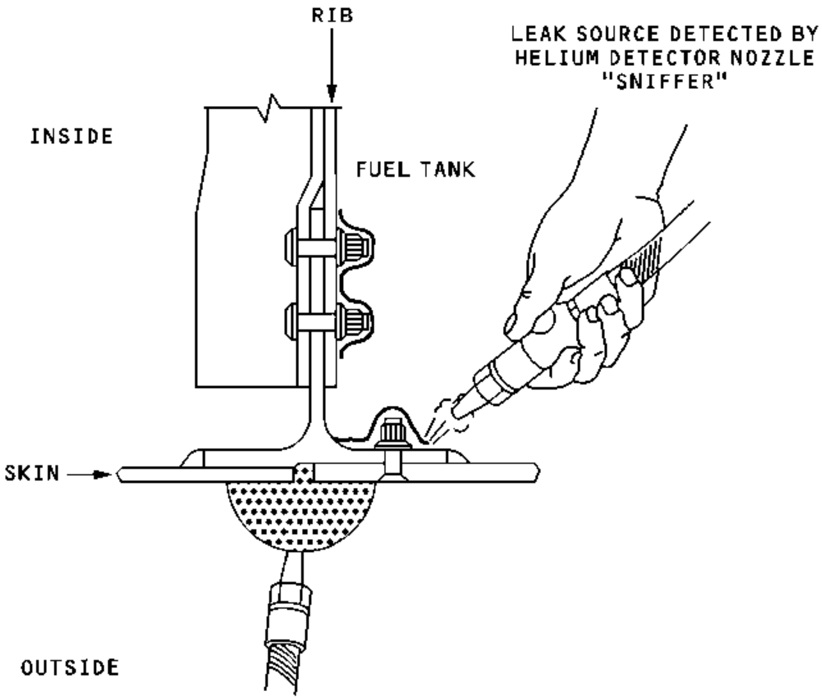

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B Leak Source Detected by Helium 'Sniffer'
B Figure 507

TANKS - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

RB ONLY USE MATERIALS SPECIFIED IN THE MAINTENANCE MANUAL,
RB INSIDE TANK LOCATIONS AS THESE HAVE BEEN APPROVED AS NOT
RB LEAVING RESIDUAL PARTICLES THAT CAN BLOCK ENGINE FILTERS.
RB THE ONLY CLOTH PERMITTED IS LINT FREE CLOTH PART NUMBER
RB 7413902.

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1. General

(1) This topic details the procedures for inspecting all aircraft fuel tanks for leakage of fuel and for internal damage to components, pipes and structure. These procedures should be carried out in conjunction with the following specific precautions and procedures:

Microbial Contamination of Fuel Tanks (Ref. 12-32-00).

Tank Entry Precautions (Ref. 28-10-00, Servicing)

Fuel Leak Locating and Tracing (Ref. 28-11-00, Adjustment/Test)

(2) Externally the aircraft must be inspected for any signs of fuel leakage. This is normally apparent by fuel dripping from the external surface of the aircraft or the presence of fuel in dry bays. Small leaks will not be so apparent and are usually shown by discolouration of the paint on the leaking surface or the accumulation of dust and dirt which adheres to the leaking fuel to form grimy deposits. If any leakage is suspected further investigation must be carried out (Ref. paras.5. and 6.). The aircraft must also be checked for any signs of structural damage not high-lighted by the leakage of fuel.

(3) Internally the fuel tanks must be inspected for any signs of damage to sealant, components, pipes and integral structure and any evidence of microbial contamination. This part of the inspection will necessitate entry into the tank and all safety precautions and procedures must be observed.

(4) If the fuel tanks have been entered for maintenance, the L.P. fuel filter is to be replaced within 100 hours. Raise an ADD Cat. "Q" 100 hours to cover this.

AREA TO BE INSPECTED	ACCESS PANELS
Nacelle equipment dry bay	531/631 AT 531/631 BT 532/632 AT 533/633 BT 533/633 DT 533/633 FT 535/635 AT
Overwing fillet	291/292 CT 291/292 FT 291/292 HT 291/292 JT 291/292 KT 295/296 AT 295/296 CT
Wing leading edge fillet	513/613 B 513/613 D 513/613 F 513/614 A 513/614 C 513/614 L

Access Panel Data - Top Surface
Table 601

AREA TO BE INSPECTED	ACCESS PANELS
Forward wing root	511/611
Underwing fairing	191/192 KB 191/192 SB 193/194 EB 193/194 PB 195/196 EB 197/198 FB
Wing rear dry bays	541/641 AB 542/642 AB 543/643 AB 543/643 BB 544/644 BB 544/644 CB

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AREA TO BE INSPECTED	ACCESS PANELS
Baggage compartment	131 WS
Rear fuselage equipment compartment	153 AB 153 BB 153 DB 153 EB 153 FB

Access Panel Data - Bottom Surface
Table 602

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2. Full Inspection - External (Ref. Fig. 601 and 602) (Ref. Tables 601 and 602)

(1) Completely inspect the following areas for signs of fuel leakage and structural damage:

NOTE: Any area where leakage is suspected must be noted and further investigation carried out. Structural damage must be investigated and appropriate remedial action taken.

Wing access panels must be refitted in accordance with 53-00-00 or 57-00-00, Removal/Installation.

(a) The top and bottom surfaces of the wings, particularly around the fuel tank access panels, at water drain points and along lines of riveted structure.

(b) The bottom surface of the fuselage under the fuselage fuel tank cells.

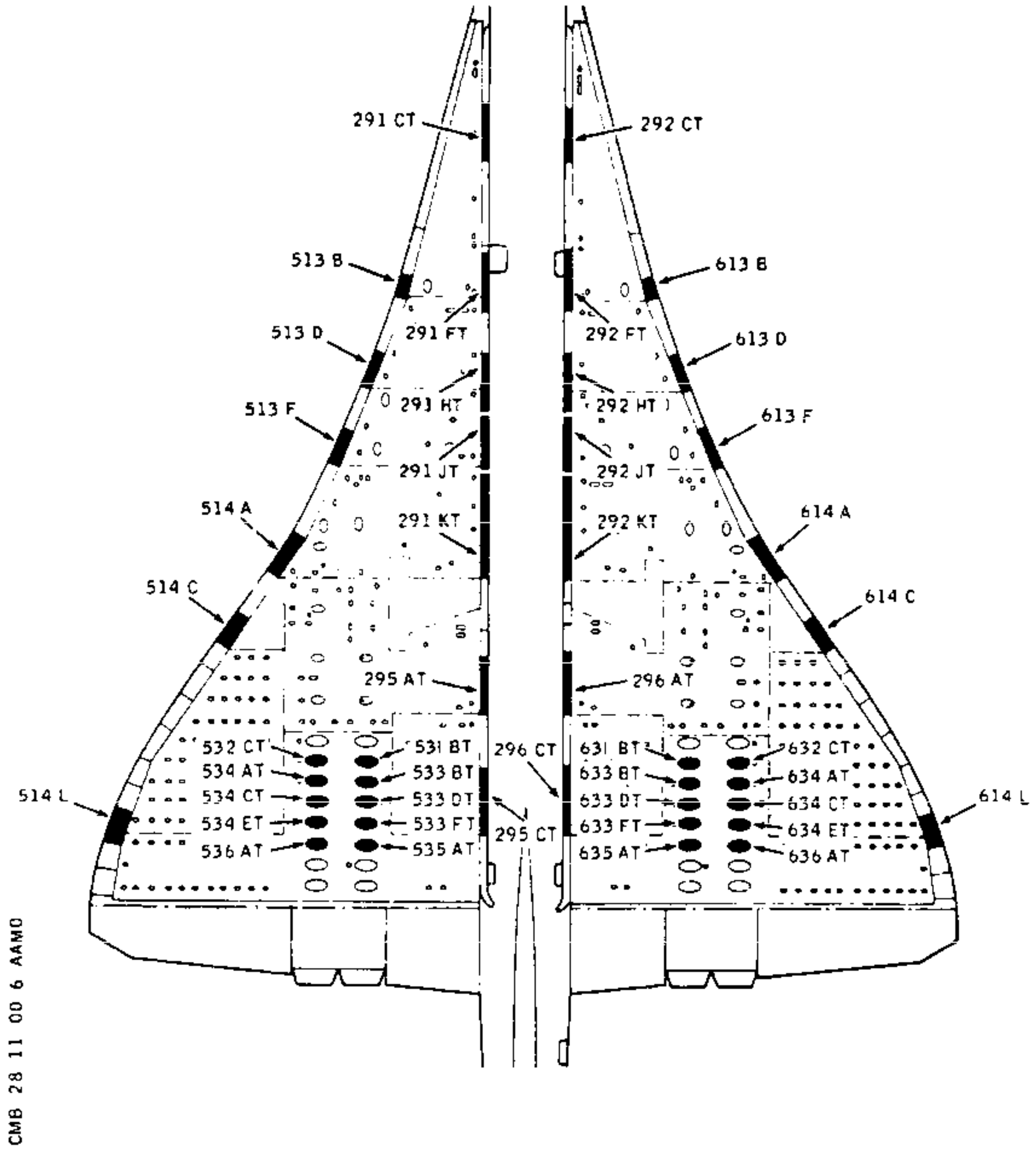
(c) The rear fuselage around tank 11 and the fin root.

(d) The interior walls of the main landing gear compartment.

(e) The nacelles, particularly the intake areas.

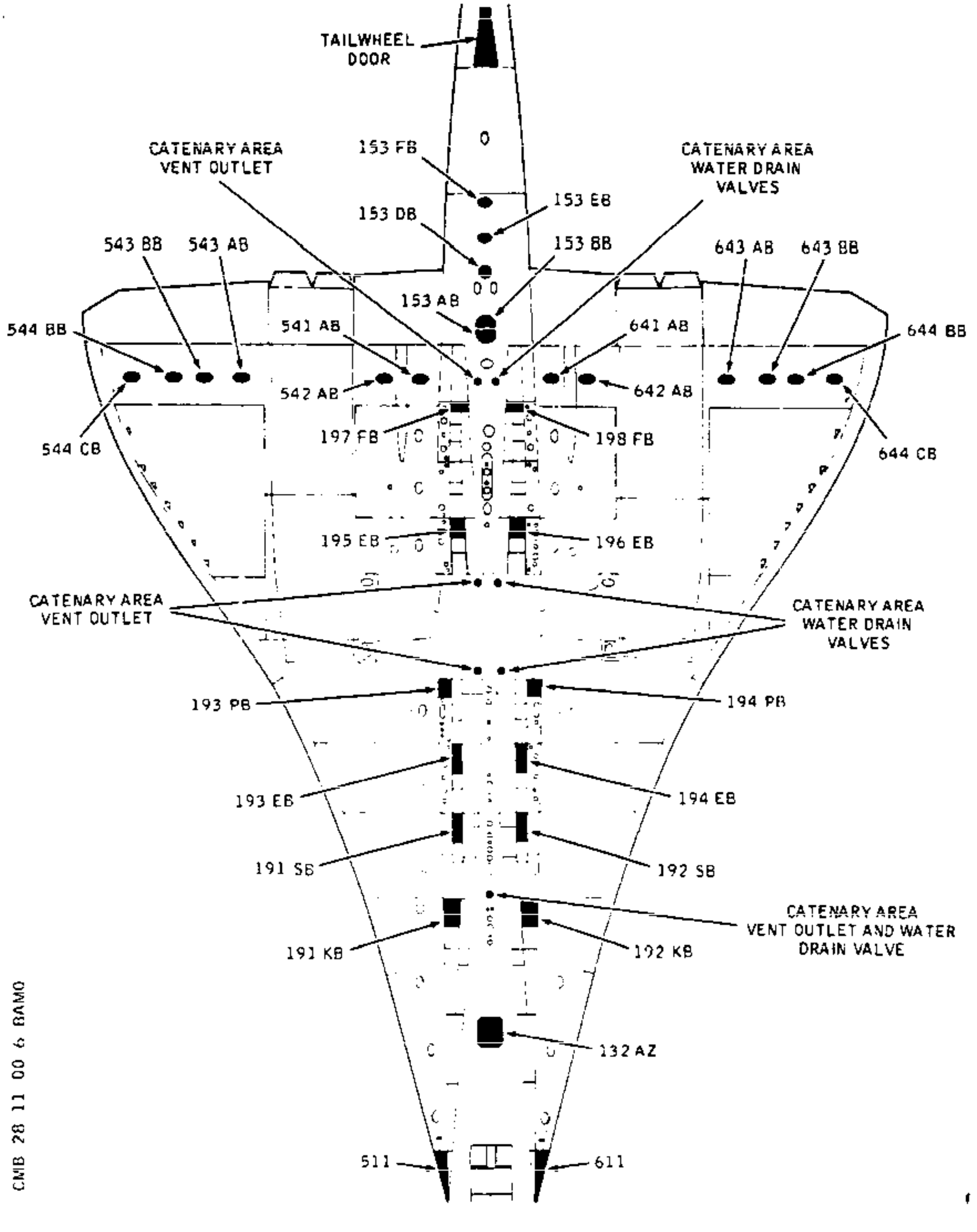
(f) The fairings under the pump locations in the wing tip tanks 5A and 7A.

(2) Remove the access panels and check the interior of the dry bays above the nacelles and behind the rear fuel tanks. Refit the access panels.



- Fuel Tank External Inspection - Access Panel Location, Top Surface

Figure 601



- Fuel Tank External Inspection - Access Panel Location, Bottom Surface

Figure 602

(3) Remove the access panels and check the interior of the equipment dry compartment in the rear fuselage, particularly the rear bulkhead of tank 6 fuselage cell and the forward bulkhead of tank 11. Refit the access panels.

(4) Visually check the rear bulkhead of tank 11 by viewing it through the tail wheel door aperture in the tail cone.

(5) Operate the catenary area water drain valves and check for presence of fuel. This would indicate leakage from the interior walls of the fuselage fuel tank cells. Also check the area around the catenary vent outlets for signs of fuel leakage.

(6) Remove the access panels in the overwing fillets and underwing fairings and check the interior. Refit the access panels.

(7) Remove the access panels in the wing leading edge fillet and check the interior. Refit the access fillet and check the interior. Refit the access panels.

(8) Remove the access panels in the forward wing root and check the interior. Refit the access panels.

(9) Remove the access panel and check the interior of the forward baggage compartment, particularly the forward bulkhead of tank 9 centre cell. Refit the access panel.

3. Full Inspection - Internal (Ref. Fig. 601 and 602) (Ref. Tables 601 and 602)

(1) Remove the appropriate access panels and enter the tank. Completely inspect the interior of the tank and ensure that the following requirements are met:

(a) All components and pipes in the tank to be correctly installed, electrically bonded, and free from damage, corrosion or distortion of any kind. Any defect must be rectified.

(b) All structure in the tanks to be free from damage, corrosion or distortion of any kind. Any defect must be rectified.

(c) The sealant in the tank to be in good condition and undamaged. Any defect must be rectified.

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(d) The tank to be free of microbial contamination. If any is present, proceed in accordance with 12-32-00.

(e) All fuel pump screens and drain passages in the floor of the tank to be clean and unobstructed.

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Refit all access panels as detailed in 53-00-00 and 57-00-00, Removal/Installation.

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4. Partial Inspection - External

(1) The following areas should be checked when confimation merely of freedom from major leakage is required, e.g., during a refuelling stop:

(a) The top and bottom of the wings, particularly around fuel tank access panels, at water drain points and along lines of riveted structure.

(b) The bottom surface of the fuselage under the fuselage fuel tank cells.

(c) The rear fuselage around tank 11 and the fin root.

(d) The interior walls of the main landing gear compartment.

(e) The nacelles, particularly the intake areas. Pay particular attention to any fuel leak from the bolts attaching the ducting for the cables that run fore and aft on the lower surface of the wing. Access to this location is in the gap between the forward and rear ramps.

(f) The fairings under the pump locations in the wing tip tanks 5A and 7A.

5. Leak Category Definition

(1) To enable the appropriate action to be taken, the degree of any fuel leakage from the tanks is assessed in accordance with the following definitions. The fuel tanks should be full if possible (Ref. Weight and Balance Manual).

Category A : Seepage

A leak wetting an area not exceeding 6 x 6 in (150 x 150 mm), after the surface has been wiped clean and 15 min allowed to elapse. The fuel should not flow or fall in droplets.

Category B : Running Leak

A leak greater than a seepage, fuel reappears immediately after the surface has been wiped and falls in drops. Leak rate to be assessed to the following sub-categories to determine action to be taken:

B1 - up to 15 drops per minute

B2 - over 15 and up to 30 drops per minute

B3 - over 30 and up to 60 drops per minute

B4 - over 60 drops per minute

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6. Fuel Leakage - Action to be Taken (Ref. Fig. 603)

CAUTION: SUSPECTED STRUCTURAL DAMAGE MUST BE INVESTIGATED AND ALL NECESSARY ACTION TAKEN BEFORE SEALANT REPAIRS, EITHER TEMPORARY OR PERMANENT, ARE MADE.

(1) In the illustration 'Fuel Leak Detection and Action' (Ref. Fig. 603) the aircraft is divided into zones and, by use of the Action Code defined in Table 603, the action appropriate to a leak in any zone is specified.

(2) Temporary Repairs

(a) Temporary repairs (using the procedure defined in Approved Repairs) must be carried out whenever possible to reduce the degree of fuel leakage to a minimum, irrespective of the leak category or permissible leak rate.

(3) Wing Leading Edge - Leak in Category B2 and Above (more than 15 drops per minute).

(a) If the leakage is in the vicinity of the mineral-insulated de-icing heater cables, the non-metallic coating applied to these cables must be inspected for freedom from deterioration. Any defective areas of the coating must be repaired in accordance with 20-25-24.

CODE	ACTION TO BE TAKEN
I	No action
II	No repair work required. Checks must be done to ensure that the leak is not worsening
III	No immediate action required. Frequent checks must be done to ensure that the leak is not worsening. Repair work is advised at the next aircraft scheduled maintenance check.
IV	Repairs are to be carried out as soon as possible, preferably before the next flight.
B B B V	Repairs must be carried out before the next flight. See notes below for aircraft at overseas base.

Action Code (Ref. Figure 603 (Sheet 1))
Table 603

B All fuel tank leaks in excess of 60 drops per minute are to be reported to Technical Services Office. When reporting the leaks, the following information is required:

1. Leak rate in drops per minute.

2. Location, giving spar position or panel identification number to accurately identify the leak as it becomes externally visible.

3. The extent of the fuel runs along the lower wing and fuselage surfaces and location of drips.

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4. All fuel leak rectification on Concorde requires that Air Form 5678 is completed.

References to assist in fuel leak rectification work:

(a) Fuel leak diagram is BA Dwg 0-43670.

(b) Cracks in expansion joint are to be repaired using Repair Scheme 57-42045.

(c) The temporary Repair Scheme 57-42098 is available to externally seal the expansion joint.

Should leaks be identified at out stations which are in excess of 60 drops per minute, check the aircraft log for existing DDAs that may cover the leaks. For all leaks in Category V in Zone 1 (Sub Zones 1.1 to 1.5) found at out stations (within two stops of return to LHR), the aircraft may be released with a leak of up to 90 drops per minute provided:

(a) No structural defect is evident.

(b) Appropriate internal areas aft of leakage point are inspected for signs of fuel ingress from the external leak in question and none are found. Ensure all access door seals are intact and will prevent any fuel ingestion.

(c) The leak must not run onto undercarriage due to risk of fire from hot brakes.

(d) Raise ADD for a thorough investigation on return to LHR.

<u>NOTE</u>: The above does not apply to leaks in zones 2, 3 and 4.

7. <u>Fuel Leak - Tracing, Using Automate Yellow 662F Dye in Fuel</u>

<u>WARNING</u>: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL TANK C.G. LIMITATION DETAILED IN 28-25-00, SERVICING, DEFUELLING LIMITATIONS.

(1) To prove a tank, add first Automate Yellow 622F to the empty tank then refuel the tank to high level capacity (1 kg Automate Yellow 662F per 8,350 litres).

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(2) Test

After a minimum of 30 minutes, check for cracks with U/V lamp on the area under test and check that there is no leakage. If defects are found, repair as per Maintenance Manual.

Suppliers of Automate Yellow 662F are:

Williams (Hounslow) Ltd
Grenville House
Hiberina Road
Hounslow
Middx TW3 3RX

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ZONE			ACTION CODE (REF. TABLE 603)					AREA TO BE INSPECTED (SEE NOTE **)
NO.	DESCRIPTION	SUB-ZONE NO.	SEEPAGE (CAT.A)	RUNNING LEAK (CAT.B)				
				B1 0-15	B2 15-30	B3 30-60	B4 >60	
1	WING AND FUSELAGE EXPOSED EXTERNAL SURFACES (SEE SHEET 2 FOR DEFINITIONS)	1.1	II	II	III	IV	V	
		1.2	II	II	III	IV (SEE **)	V	MAIN LANDING GEAR BAYS. FORWARD AND REAR LOWER FAIRINGS. REAR FUSELAGE EQUIPMENT BAYS.
	(a)	1.3	II	II (SEE**)	V	V	V	REAR LOWER FAIRINGS. REAR FUSELAGE EQUIPMENT BAYS.
	(b)	1.3	II	II	III	IV	V	
		1.4	II	II	III	IV (SEE **)	V	WING EQUIPMENT BAYS. INTAKES.
		1.5	II	II	III	IV (SEE **)	V	TAIL CONE.
2	MAIN LANDING GEAR BAY AND ALL OTHER ENCLOSED AREAS ADJOINING FUEL TANK BOUNDARIES		III (SEE ***)	IV (SEE ***)	V	V	V	
3	FUEL TANK WALLS UNDER VAPOUR SEAL BARRIERS (AFTER SB 53A-023)		I	II	III	IV (SEE **)	V	SUB-ZONES 1.2 OR 1.3, AS APPROPRIATE.
4	WING BOTTOM SURFACE ABOVE INTAKES		III	V	V	V	V	

** INSPECT THE AREAS SPECIFIED FOR EVIDENCE OF FUEL INGRESS. UPON DISCOVERY OF LEAK AND THEREAFTER AT INTERVALS NOT EXCEEDING 5 FLIGHTS. IF EVIDENCE OF LEAK INGRESS IS DISCOVERED, THE APPROPRIATE ACTION SHOULD BE TAKEN TO REPAIR THE LEAK BEFORE FURTHER FLIGHT (CODE V)

*** INSPECT FREQUENTLY TO CHECK THAT LEAK IS NOT INCREASING RAPIDLY.

(a) BEFORE MOD. 2228

(b) AFTER MOD. 2228

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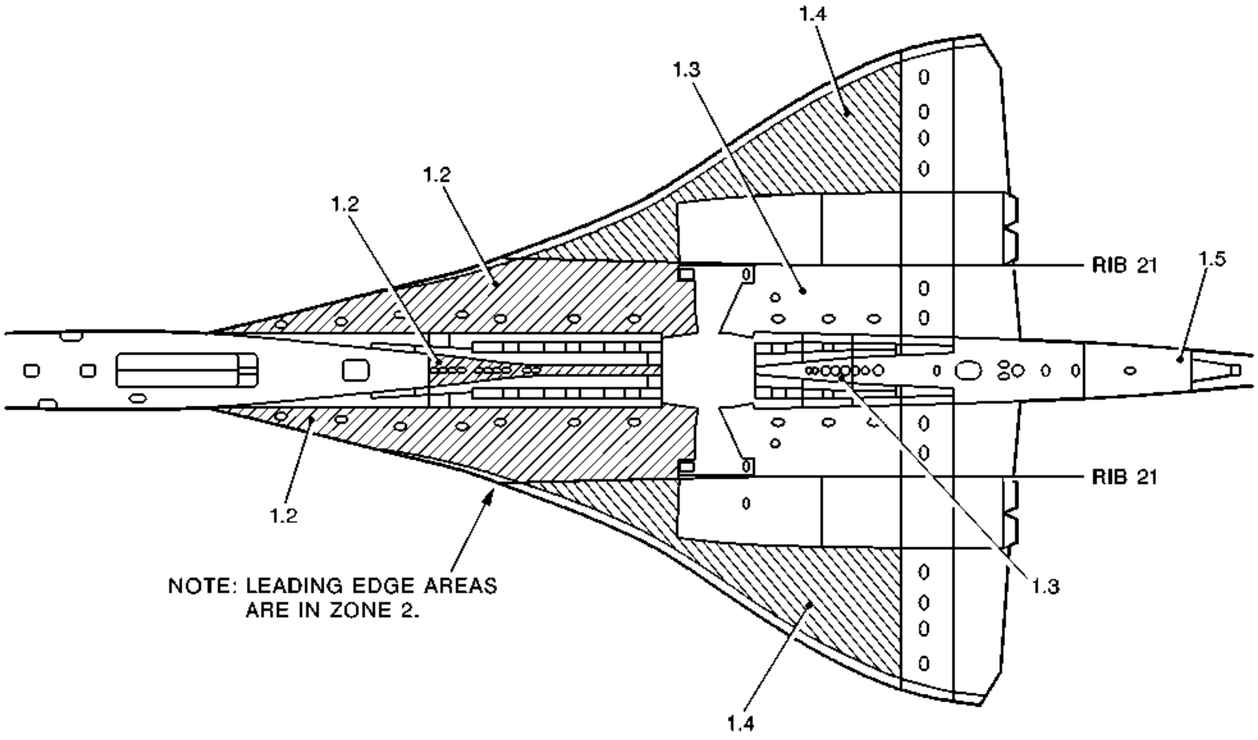
Fuel Leak Detection and Action (Sheet 1 of 2)
Figure 603



DEFINITIONS OF SUB-ZONES FOR EXTERNAL SURFACES (ZONE 1)
(REF. SHEET 1)

1.1 UPPER SURFACE OF WINGS.

1.2* LOWER FUSELAGE AND WINGS INBOARD OF RIB 21, FORWARD OF MAIN LANDING GEAR BAYS.

1.3* LOWER FUSELAGE AND WINGS INBOARD OF RIB 21, AFT OF MAIN LANDING GEAR BAYS.

1.4 LOWER SURFACE OF WINGS OUTBOARD OF RIB 21.

1.5 TANK 11 OUTER SURFACE.

*EXCLUDES LOWER FUSELAGE/WING FILLET FAIRINGS. WHICH ARE COVERED BY ZONE N0.2.

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Fuel Leak Detection and Action (Sheet 2 of 2)
Figure 603

TANKS - CLEANING/PAINTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

This Cleaning/Painting procedure covers the cleaning of the fuel tank interior after the completion of maintenance in the tank, the decontamination of the tank in the event of large fungicidal growths forming, and the repainting of the primer surface if this has been damaged. These procedures should be carried out in conjunction with the following specific precautions and procedures:

OPERATION	REFERENCE
Refuelling	12-11-28
Fuel sampling and analysis	12-32-00
Tank entry, protective clothing, venting, leaving a tank	28-10-00, Servicing
Tank capacities	28-11-00, Description/ Operation
Defuelling	28-25-00, Servicing

Cleaning the tank is accomplished by removing as much foreign matter as possible using a vacuum cleaner and then flushing the tank with fuel until all traces of dirt and foreign matter have been removed.

Decontamination of the fuel tanks may be required either when contamination has been found present in a routine water sample and sterilization of the tank is considered necessary to prevent fungus growths forming, or when fungus growths have already formed and decontamination of the tank is necessary to kill the growth. Decontamination necessitates the complete immersion of the tank interior in fuel containing a fungus killing additive. The approved additive is Ethylene Glycol Monomethyl Ether (EGME), used in a 0.25 per cent solution. A four day period is needed to effect a complete cure. Fuel containing EGME at a concentration of 0.15 per cent is approved by Rolls-Royce for use in their engines.

The primer surface will only need repainting if it has been damaged, by clumsy removal of sealant during a repair, causing parts of the surface to be removed, or by corrosion. Before repainting, remove all remaining paint from the affected area and clean and deoxidize the surface until the bare metal is showing. Apply a coat of Alocrom protective treatment before applying the primer coat.

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2. Fuel Tank Cleaning

A. Equipment and Materials

DESCRIPTION	PART NO.
Vacuum cleaner, complete with nozzles	-
Assorted brushes, including: paint brushes cleaning brushes stiff bristle brush	-
RB Eurotwill cloth	-
Cleaning solvent (Ref. 20-30-00, No.476)	ICI 850-1012

B. Prepare to Clean Tank Interior

(1) Ensure that all maintenance in the tank has been completed satisfactorily, and that no further entry to the tank is intended, before commencing cleaning operations.

(2) Ensure that the tank is correctly prepared for entry and well ventilated.

C. Clean Tank Interior

(1) Enter the fuel tank.

(2) Using the vacuum cleaner, remove all loose debris and dirt from the tank. Commence cleaning at the furthest extremity of the tank from the access panel and work gradually back to the panel, removing or rolling up access mats from the floor as necessary. Use a brush to dislodge any debris from inaccessible corners. Any foreign bodies too large to be removed by the vacuum cleaning must be removed by hand and deposited outside the tank.

RB (3) Using Eurotwill cloth moistened with cleaning fluid (fuel) clean all accessible areas of the tank and wipe dry using
RB clean Eurotwill cloth.

RB NOTE: Any break up of Eurotwill cloth must be avoided. If this occurs remove all pieces from the tank.

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R (4) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (5) Clean all access panels with cleaning solvent applied with Eurotwill cloth and wiped dry whilst still wet. Refit the access panels.

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D. Conclusion

(1) Refuel the relevant tank.

(2) Defuel the tank.

(3) Remove the appropriate access panel and inspect the fuel pump screens. If the screens are clear the tank may be passed as clean. If the screens are dirty, clean them with fuel and repeat steps (1) to (3) until they are clear.

3. Decontamination (EGME)

A. Equipment and Materials

DESCRIPTION	PART NO.
Decontamination additive Ethylene Glycol Monomethyl Ether (EGME)	-
EGME mixing equipment	-
e.g. injection nozzles	-

B. Prepare to Decontaminate Tank Interiors

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) When contamination of the suspect tank has been confirmed, refit all the access panels in the tank and prepare to refuel the tank.

R (3) Using suitable mixing equipment, prepare a quantity of fuel sufficient to fill the contaminated tank by adding EGME to make a 0.25 per cent solution.

C. Decontaminate Tank Interior

(1) Refuel the tank with the additive prepared fuel.

(2) Allow the tank to remain in this state for four days.

D. Conclusion

(1) After four days have elapsed:

(a) If the tank has been sterilized, dilute the fuel in the tank to a 0.15 per cent solution of EGME and take a sample to ensure that the contamination has been minimized. The aircraft may now be cleared for flight.

(b) If the tank has been decontaminated to remove fungus growth, defuel the tank and ensure that all dead spores are removed both from the fuel and the tank. The fuel may now be used provided the solution of EGME does not exceed 0.15 per cent, and the aircraft cleared for flight.

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4. Painting - Primer Surfaces

A. Equipment and Materials

DESCRIPTION	PART NO.
Assorted brushes, including: paint brushes cleaning brushes stiff bristle brush	-
RB Eurotwill cloth	-
Cleaning solvent (Ref. 20-30-00, No.476)	ICI 850-1012
Pumice powder	-
Masking tape	-
Deoxidizing solution (Ref. 20-30-00, No.558)	Deoxidine 202
Alocrom treatment (powder) (Ref. 20-30-00, No.638)	Alocrom 1200
Nitric acid (concentrated)	-
Barium chromate primer (Ref. 20-30-00, No.631)	CM031
Containers for Alocrom and Deoxidine solutions e.g. plastic buckets	-

B. Prepare to Paint

(1) Mask off the surrounding area not to be painted.

(2) Using cleaning solvent, completely clean the area to be repainted until the bare metal is reached.

(3) Wash the area with clean cold water and allow to dry.

(4) Remove any loose corrosion products using a stiff bristle or plastic brush or any other suitable non-metallic scourer.

CAUTION: DO NOT USE ANY TYPE OF METALLIC SCOURER.

(5) Rub the area to be treated with a paste of finely powdered pumice as evenly as possible.

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(6) Wash the area with clean cold water ensuring that all pumice particles are removed. Wipe the area dry with clean
RB Eurotwill cloth.

RB (7) Clean the area with cleaning solvent applied with Eurotwill
RB cloth and wiped dry whilst still wet using clean Eurotwill
RB cloth.

NOTE: Work from the centre of the area outwards to prevent recontamination from the surrounding area.

C. Application of Deoxidine 202

(1) Thoroughly stir the Deoxidine 202 in the supplied container and decant into a conveniently sized plastic bucket.

(2) Apply one brush coat of Deoxidine 202 evenly over the area to be treated and allow to dry for 15 to 20 minutes.

(3) Remove all traces of Deoxidine 202 by swabbing the area with clean cold water. Frequently change the water used for swabbing.

D. Mixing of Alocrom 1200

WARNING: THE DUST OF ALOCROM 1200 POWDER IS TOXIC, AND NITRIC ACID HIGHLY CORROSIVE. WEAR PROTECTIVE CLOTHING DURING THESE OPERATIONS.

NOTE: The following instructions apply to the mixing of one gallon of Alocrom solution. To mix larger quantities increase the component amounts accordingly.

(1) Pour one imp. gallon (4.54 l) of distilled or demineralised water into a suitable polythene or stainless steel vessel.

(2) Add five ounces (142 gm) of Alocrom 1200 powder to the water.

(3) Add half a fluid ounce (14 ml) of concentrated nitric acid to the mixture.

(4) Stir the solution well until all the powder is dissolved. A small amount of insoluble matter may settle out, this can be disregarded.

(5) Allow the solution to stand for 24 hours prior to use.

E. Application of Alocrom 1200

RB (1) Soak a number of Eurotwill cloths in the solution.

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RB (2) Place these cloths over the area and press them firmly into place in full contact with the metal skin.

RB (3) Keep the cloths moist by brushing on more solution as necessary.

(4) After about one minute of treatment lift a corner of the
RB cloth and check the progress of the treatment. Replace the
RB cloth if the treatment is not complete.

RB (5) Continue the treatment until a pale golden yellow film is obtained beneath the cloth.

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(6) When the treatment is complete, carefully strip off the
RB cloth, taking special care to avoid any sliding action.

(7) Wash the area thoroughly with clean water and dry it with a supply of clean low pressure air.

F. Mixing of Epoxy Primer

(1) The primer paint finish is supplied as a primer and activator. Prepare a sufficient quantity for brush application by mixing the primer and activator in an even 50-50 mix. The pot life of the mixed primer is eight hours.

(2) Allow the mixed primer to stand for 30 minutes prior to application.

G. Application of Epoxy Primer

(1) Apply one brush coat of the mixed primer to the prepared surface to give a dry paint scheme weight of 0.85 to 1.15 oz/sq yd (28.8 to 39.0 gm/sq m). This is an average thickness of 0.0006 to 0.0008 in (0.0015 to 0.0020 mm).

(2) Allow the painted surface to dry at room temperature for 16 hours. Do not use forced drying inside the fuel tanks under any circumstances.

(3) After the drying time has elapsed allow a further 48 hours curing time before applying any viton sealant to the painted area.

TANKS - APPROVED REPAIRS

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE PRECAUTIONS FOR ENTERING FUEL TANKS DETAILED IN 28-10-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 801)

When fuel tank sealant is being repaired, the safety precautions detailed in the following topics must be observed, wherever appropriate:-

R Storage - Servicing (Ref. 28-10-00, Servicing)

Defuelling (Ref. 28-25-00, Servicing)

In addition, the correct protective clothing and equipment must be used (Ref. 28-00-00, Servicing).

The sealants used for the repair should be those having the shortest application life (Ref. Table 801), provided that this life is sufficient to allow the sealant to be applied in the conditions prevailing.

During application of sealants, care must be taken not to close or raise the level of drain passages which may be present. These passages allow the free flow of fuel, and any accumulated water, to reach the drain points in the lowest part of the tanks.

A failed fillet seal, or fastener seal, is repaired by removing all the faulty sealant, cleaning the structure surface thoroughly, and applying new sealant to the same size and shape as the original sealant.

Repair to a failed interfay seal, or prepacked seal, may necessitate either disassembly of the appropriate structure or the use of sealant injection technique and/or raising the seal plane (i.e., application of an additional overcoat of sealant to increase the thickness of the seal). The new seal plane must completely isolate the failed seal from fuel, but should not be raised any more than is absolutely necessary.

R To assist in tracing and repairing fuel leaks, this topic
R includes a series of illustrations of specific structural
R joints in the tanks. The illustrations show the 'tunnels'

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that are formed in the structure by multiple-plate assemblies, and the positions of the standard sealing bolts which may be removed to carry out a repair, using the hollow bolt injection procedure (Ref. para.6.). Alternatively, repair of these and similar joints may be effected by the hypodermic injection procedure (Ref. para.7.).

To reduce aircraft-on-the-ground time, temporary repairs that use epoxy resin MH377-1 are included. This resin has a very short application life and a high degree of curing is achieved in 1 h at 20 deg C.

Fuel leaks may be caused by structural damage. In this case, reference should be made to the Structural Repair Manual and a full investigation must be carried out, followed by all necessary rectification action, before sealant repairs are commenced.

Failed O-ring seals must be removed where possible, the component surfaces thoroughly cleaned, and a new seal of the correct type fitted. Where removal of the seal is not possible (e.g., at fixed fittings such as anchor nuts) the leak area must be repaired by capping and overcoating the fasteners with sealant.

2. INTEGRAL FUEL TANK REPAIR

The following procedure is issued to introduce alternate methods and materials which should be used when repairing leaks from integral fuel tanks.

A. Leak Detection

Assess and locate leaks as detailed in MM 28-11-00 Page 501.

The precise location of the leak exit point, where fuel appears on the external skin of the wing may be useful as guidance to which tank access panels should be removed for access. The entry point for fuel entering the seal plane within the tank is not necessarily in the same location.

B. Repair

(1) Sealant Removal

(a) Remove sealant in leak source area using suitable plastic or phenolic tools as shown in MM 28-11-00 Fig.802. Care must be taken to avoid damaging the primered metal surface.

(b) If the primered surface is damaged:-

1 Lightly abrade the surface to remove any flaking paint.

2 Thoroughly degrease the surface using MEK.

R B 3 'Pad apply' a thin film of Etch Primer (Pt.No. F565-500) to all bare metal surfaces per SPM 20-22-08. Allow 30 minutes to dry.

R B 4 Brush apply 1 coat of Epoxy Primer (Pt.No. F580-2080) per SPM 20-22-03. Allow to completely dry before proceeding, 5 to 6 hours at 25°C.

R B CAUTION: DO NOT TOUCH PRIMERED SURFACE WITH BARE HANDS OR ALLOW ANY CONTAMINATION OF THE SURFACE BY FUEL ETC, PRIOR TO APPLICATION OF THE SEALANT.

B (2) Surface Cleaning

B (a) Remove any leak detector residue.

B (b) Clean an area larger than that to be sealed by pouring MEK solvent onto a clean Gauze Pad (Pt. No. GAUZE3PLY9X8) and wipe over the surface, follow immediately by drying with a clean pad. After each wipe, use a clean area of the pad. Change pads often.

B NOTE: MEK is the preferred solvent for preparing the surface for the application of new sealant. For precautions when using MEK in the fuel tank ref. 'DOK' transaction on TIME VDU.

B (3) Sealant Type and Grade

B (a) The sealant used is a two part liquid polysulphide compound which cures at room temperature to a solid resilient rubber. The grade which should be used is PR1440. (PR1440 has superseded PR1422).

B (b) An additional grade of sealant PROSEAL860B1-6 may be used to provide for 'quick repairs'. i.e. where a tank has already been re-sealed and a further small leak is found. Proseal 860 must not be used as a primary sealant.

B NOTE: Proseal 860 must not be used over uncured PR1440, curing of both sealants may be inhibited. Proseal 860 is only available in class B. (See sub para.(7) for cure details).

B (4) Classes & Application Times

B (a) The PR1440 sealant is currently available in two different classes and two application lives.

B 'A' in the part no. indicating a brushing consistency.
'B' in the part no. indicating a filleting consistency.

Para.(6) defines the specific use of each class.

The '2' of '1/2' in the part number indicates the application life of the sealant in hours. The choice of which is at the operators discretion to suit his requirements.

(b) Proseal 860 comes in a '1.6' application life, requiring application within 10 minutes of mixing.

(5) Sealant Mixing

(a) Adequate mixing is of prime importance in ensuring a proper cure of the sealant. Wherever possible sealant will be supplied in SEMKIT form. (A SEMKIT is a disposable plastic cartridge with provision for integral mixing of the accelerator and base sealant). The sealant must be at room temperature prior to mixing.

(b) To mix sealant supplied in SEMKITS:

1) Pull Dasher Rod fully out, insert Ram Rod in dasher rod and discharge approx 10% of accelerator into the base compound. Slowly push the Dasher Rod into the cartridge while pushing on the Ram Rod to evenly expel the accelerator into the cartridge.

2) Sealant may be either mixed by hand or, after removal of the Dasher Rod top, by use of a slow speed windy/pillar drill. Approximately 50 strokes at a rate of 5 spiral revolutions per strike will be required to fully mix the sealant.

3) Finish mixing with Dasher Rod fully extended and remove the rod by unscrewing.

4) Screw a nozzle into the cartridge, remove snap-on cap and place cartridge in sealant gun. Pt.No. MODEL250GUN for air operation and Pt.No. 221830 for hand operation.

5) On the few occasions when a nozzle is not supplied with the SEMKIT, Pt.No. 440NOZZLE may be ordered.

(6) Application

(a) Ensure that the skin temperature of the structure to which sealant will be applied is not less than 10 deg C.

(b) Fillet seals:

1) Apply a precoat of Class A2 sealant to the surface with a brush. Scrub well into crevices and cover the entire surface to be sealed, extending beyond the area where B2 sealant will be applied. Final sealant thickness to be nominaly .005" to 010".

<u>CAUTION</u>: DO NOT ATTEMPT TO BUILD UP LARGE THICKNESSES OF CLASS A SEALANT THIS MAY ONLY BE DONE WITH CLASS B SEALANT.

2) Apply a small fillet of Class B2 sealant. This must be done carefully to avoid trapping air in the fillet.

3) Using a suitably shaped tool, (Fig. 802) press the fillet firmly into position.

4) Apply a second application of Class B2 sealant to produce a full bodied fillet.

(c) Fastener Fillet Seals:

1) Follow the same basic procedure as for fillet sealing but form fillet with Class B2 sealant as shown in Fig.801. Ensure that the reverse side of fastener heads are coated with sealant.

(d) Injection Seals:

1) Passages requiring injection seals, should be cleaned out and injected with Class B2 sealant using sealant gun 950-60H and 440NOZZLE shaped to suit the application. B2 sealant may be applied over the injected A2 sealant if necessary to fill a cavity.

(7) <u>Curing</u>

(a) The sealant must reach its tack free state before re-fueling can commence. This will take approx. 36 hours for the 2hr application life sealant and 10 hrs for the 1/2hr application life, at an ambient temperature of 25 deg C. However, these times will double/halve for every 5 deg C. change. In low temperatures the tack free time may be speeded up by use of heat lamps/hot air blowers up to a maximum temperature of 50 deg C. Humidity should be maintained at a minimum of 40%, if necessary by positioning open containers of water in the tanks.

(b) PROSEAL860B1-6 will reach tack free state approx 2 hrs after application when used at 25°C. Similar time/temperature changes apply as for the PR1440 grade.

C. Use of PR1828B Sealant

The following procedure is issued to introduce a quick cure sealant for repairing leaks from integral fuel tanks.

(1) Equipment and Materials

DESCRIPTION	BA PART NUMBER
PR1828 Class B sealant	PR1828B1-2SEMKIT
PR-186 Adhesion Promoter	PR186
Etch Primer	See SPM 20-22-08
Epoxy Primer	See SPM 20-22-03
MEK Cleaning Solvent	MEK
Gauze Pads	GAUZE3PLY9X8
Sealant Cutting/Removal Tool	230631
Sealant Smoothing Tool	231349
Sealant Smoothing Tool	226242
Sealant Smoothing Tool	229394
Fitch Brush	92X1-2

<u>NOTE</u>: Before using PR1828B, PR186, MEK or any of the materials called up in the above SPM's, read the appropriate MSDS pages on the TIME system.

(2) Sealant Removal.

<u>CAUTION</u>: UNDER NO CIRCUMSTANCES MUST MEK BE USED TO SOFTEN AREAS OF SEALANT, PRIOR TO REMOVAL. GOOD SEALANT WILL BE DAMAGED, LEADING TO FURTHER LEAKS.

(a) Using the sealant cutting/removal tool, remove faulty sealant from the leak source area. Care must be taken to avoid damaging the primed metal surface.

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RB (b) If the primed surface is damaged:

- Lightly abrade the surface to remove any flaking paint.

- Thoroughly degrease the surface using MEK on a clean gauze pad.

- Pad apply a thin film of Etch Primer to all bare metal surfaces I.A.W. SPM 20-22-08. Allow 30 minutes to dry.

- Brush apply 1 coat of Epoxy Primer I.A.W. SPM 20-22-03. Allow to completely dry before proceeding (5 to 6 hours at 25°C).

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CAUTION: DO NOT TOUCH PRIMED SURFACE WITH BARE HANDS OR ALLOW ANY CONTAMINATION OF THE SURFACE BY FUEL ETC. PRIOR TO APPLICATION OF THE SEALANT.

(3) Surface Cleaning.

(a) Remove any leak detector residue.

(b) Clean an area larger than that to be sealed by wetting a clean gauze pad with MEK and wiping over the surface, immediately followed with a wipe from a clean dry gauze pad. Use a clean area of both the wet and dry pads for each wipe and change pads frequently.

(4) Application of Adhesion Promoter.

PR-186 Adhesion Promoter is designed to promote adhesion between PR1828B and the various metallic and non-metallic substrates to which it is applied. This one-part material is easily applied and rapid curing.

(a) Apply a thin coat of PR186 to the previously cleaned surfaces with a brush or gauze pad, ensuring that all the surfaces to be sealed are coated. When properly applied, the substrate will exhibit a slight gloss which is distinct and easily seen. On porous surfaces, such as sealants, several thin coats of adhesion promoter may be necessary to achieve the required gloss. At 25°C the adhesion promoter will be ready for sealant application in 20 minutes. At lower temperatures the adhesion promotor will take slightly longer.

CAUTION: IF THE ADHESION PROMOTER IS NOT OVERCOATED WITHIN 8 HOURS, THE SUBSTRATE MUST BE CLEANED WITH SOLVENT AND THE ADHESION PROMOTER RE-APPLIED.

(5) Sealant Mixing/Application.

PR1828B is a two-part polythioether polymer based sealant, providing rapid cure at low temperatures. It is currently available as a Class B sealant, indicating a filleting consistency, although it is thin enough to be used as a brushable pre-coat, if this should be required. The '1/2' in the part number indicates that the sealant has an application time of 1/2 hour and that it must be applied within 30 minutes of mixing.

Correct mixing of accelerator and base is vital. Failure to thoroughly mix ALL of the accelerator into ALL of the base material will result in, at best, extended cure time or at worst incomplete cure. Mixing of the SEMKIT should always take place with sealant at room temperature, otherwise considerable difficulty will be experienced due to increased viscosity at lower temperatures.

(a) Mixing Procedure:

- Insert ramrod into SEMKIT dasher rod.
- Pull dasher rod out approximately 1 inch.
- Push ramrod against piston inside dasher rod to unseat valve and inject 1/3 of the accelerator into the base compound.
- Pull dasher rod to mid point and inject a further 1/3 of accelerator into base compound.
- Pull dasher rod fully out, inject the remainder of accelerator into base compound and remove ramrod.

Adopting the following procedure push and pull the dasher rod the full length of the cartridge, for the number of strokes shown on the outer packaging of the SEMKIT.

NOTE: A stroke or cycle is one full in and out movement with 1/4 clockwise turn of the dasher rod.

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- Holding the cartridge firmly in one hand, push dasher rod fully home while turning in a clockwise direction.
- Adjust grip on dasher rod (i.e. move hand anti-clockwise) and pull fully out while turning in a clockwise direction.
- Repeat for the prescribed number of strokes.

- On completion of mixing fully extend dasher rod, firmly grip neck of cartridge to restrain agitator blades and unscrew dasher rod.

NOTE: Should it not be possible to unscrew the dasher rod, push the dasher rod back to the centre of the cartridge, grip agitator blades and unscrew dasher rod 1/4 turn. Fully extend dasher rod, firmly grip neck of cartridge to restrain agitator blades and unscrew dasher rod.

- Remove end cap, screw nozzle onto neck of cartridge and load into sealant gun.

(b) Application Procedure:

(i) Fillet Seals.

- Apply a fillet of PR1828B sealant to the prepared surfaces. This must be done carefully to avoid trapping air in the fillet.
- Using a suitably shaped smoothing tool press the fillet firmly into position.
- Where required apply a second application of PR1828B sealant to produce a full bodied fillet.

(ii) Fastener Fillet Seals.

- using a fitch brush (or equivalent) scrub sealant well into fastener crevices and extend sealant 1/2 inch in all directions from the fastener.

NOTE: The bristles on the fitch brush can be cut down to increase their stiffness.

- Work the sealant with a suitable smoothing tool to produce the necessary fillets.

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RB (c) Curing.

RB - The sealant MUST reach its tack free state before refuelling can commence. With PR1828B1-2 this will take approximately 2.5 hours at an ambient temperature of 25°C. The cure time will be halved or doubled for each 10°C up or down respectively. Humidity has no effect on the cure time of the material.

B 3. Sealants

CAUTION: THE MANUFACTURER'S INSTRUCTIONS FOR MIXING, USING AND STORING SEALANTS MUST BE STRICTLY OBSERVED.

A. Tools (Ref. Fig. 802)

The sealant cutting, removing and fairing tools must be made of Tufnol, or metal no harder than aluminium to specification BS L31, to reduce the possibility of damage to the structore or protective treatment. Tools for the application of sealant may also be made from wood. These tools may be made specially or adapted from existing tools that are available. Figure 802 shows the recommended patterns of tools.

B. Selection

The sealants used to effect repairs, depending upon availability and the type of leak, are to be selected from Table 801. The selection must take into account the following points:

(1) The application life quoted in Table 801 is the time during which the compound will remain suitable for its appropriate use. This life varies with ambient temperature and it is quoted for 24°C. In general, it will be doubled for every 6°C decrease in temperature, and halved for every 6°C increase in temperature. In addition, variations up or down on 50 per cent relative humidity can accelerate or retard the application life of polysulphide sealants.

B (2) Although the drying time for the sealant is the time taken for it to become tack free, sealants will continue to cure for several days.

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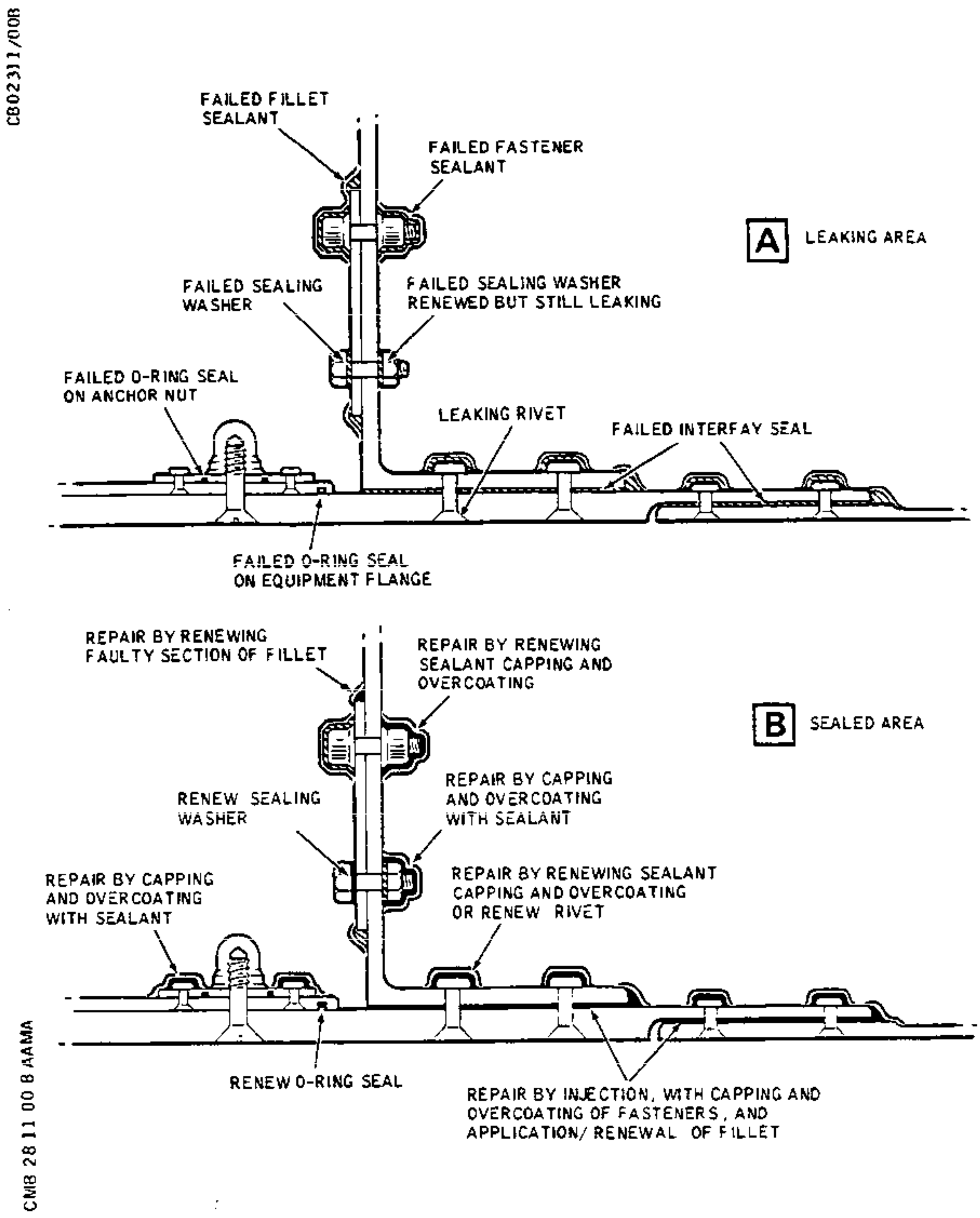
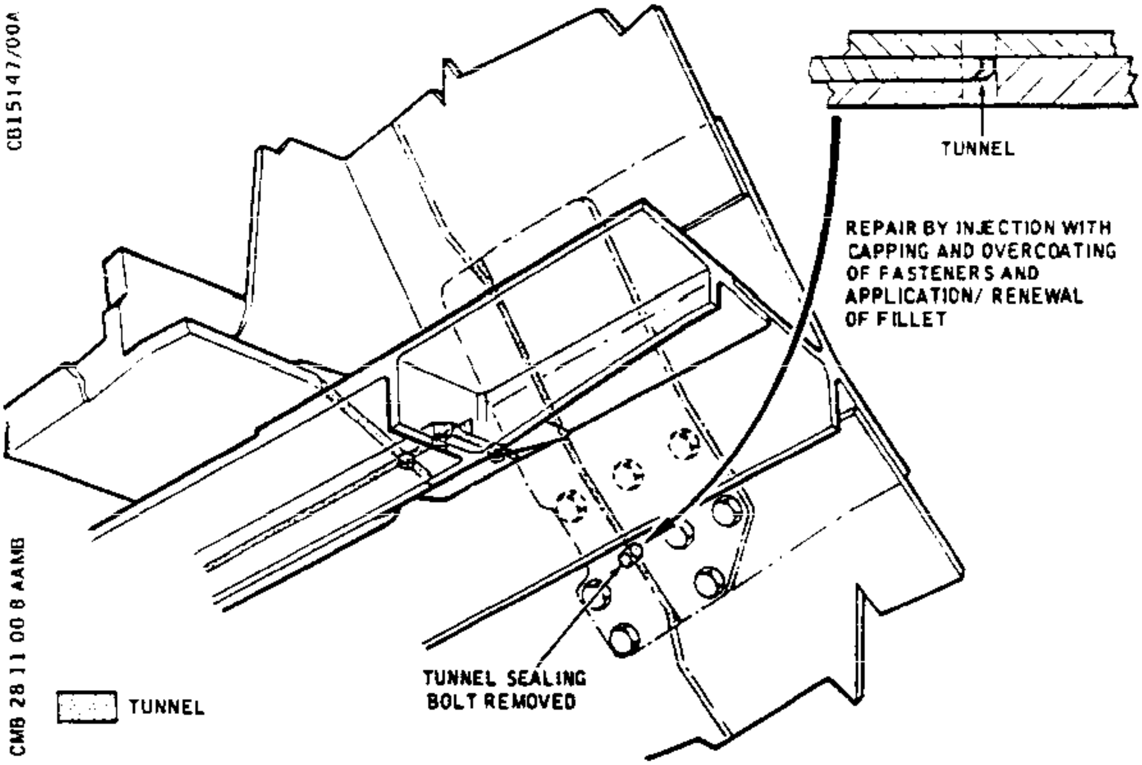


R - Typical Leak Sources and Repair Methods (Sheet 1 of 2)
Figure 801



Typical Leak Sources and Repair Methods (Sheet 2 of 2)
Figure 801

RB (3) Viton sealants will adhere only to epoxy primer and other sealant products of the polysulphide and Viton type.

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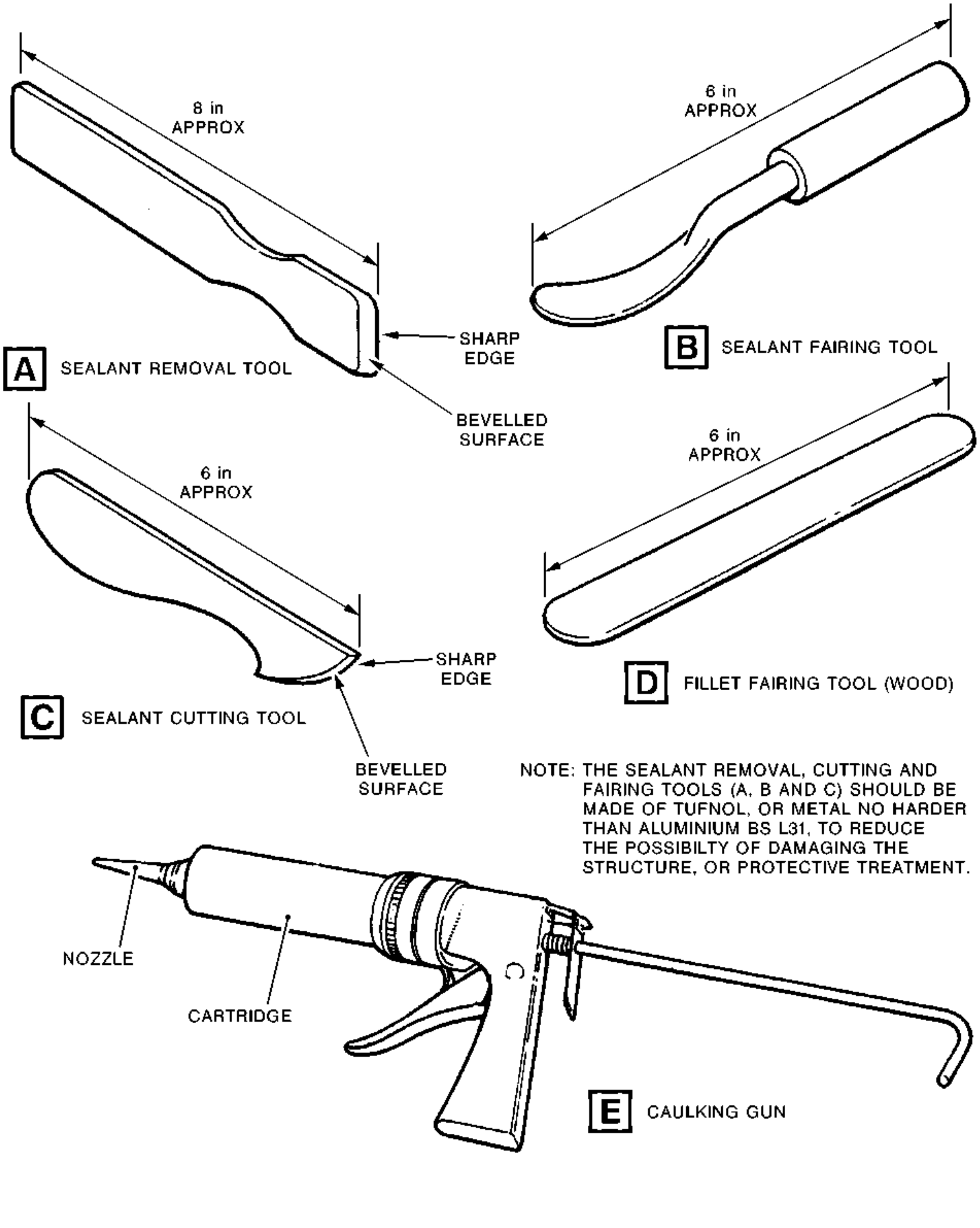

Internal Sealant Repair - Hand Tools
Figure 802

SEALANT	APPLICATION LIFE	NATURE OF FLUID	PRODUCT NO. (REF. 20-30-00)
Viton, for fillets and fastener capping:			
PR 1720F	8 h	Thick, thixotropic	352
PR 1720F (Rapid cure)	6 h	Semi-thick, thixotropic	375
Bostik 2223	2 h	Thick	A355
Polysulphide, for hollow bolt injection (Ref. para.2.B.(2)):			
PR 1422A/1/2	1/2 h	Thick	377
PR 1422B/1/2	1/2 h	Thick	378
PR 1422/2	2 h	Thick	376
PR 1422B/2	2 h	Thick	362
Polysulphide, for hypodermic injection (Ref. para.2.B.(2)):			
PR 1422BT/2	2 h	Thin	379
PR 1422A/2	2 h	Thin	361
Viton, for final overcoating:			
PR 1710	8 h	Thin	355
PR 1720SM	8 h	Semi-thick	351
PR 1720SM (Rapid cure)	6 h	Semi-thick	380
Bostik 2221	6 h	Semi-thick	A354

Sealant Application Life, Nature and Use
Table 801

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C. Mixing

The sealant kit must be allowed to attain a temperature of not less than 17 deg C (63 deg F) prior to mixing.

Thinners must not be used under any circumstances.

The base and accelerator must be from the same kit. Materials from one kit must not be mixed with those from another.

Mixing must not be carried out until the sealant is required for use.

After mixing, the sealant must be allowed to stand for a short period.

D. Handling

If a sealant cannot be applied smoothly, it must be discarded. Further use will result in an unsatisfactory repair.

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4. Cleaning Solvents

Approved cleaning solvents are listed in Table 802.

CLEANING SOLVENT	PRODUCT NO. (REF. 20-30-00)
Methylethylketone (MEK)	470
Methylisobutylketone (MIBK)	483
Trichloroethane	471
Halogenated hydrocarbon solvent R.113	484

Cleaning Solvents
Table 802

WARNING: 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC.

TRICHLOROETHANE AND R.113 ARE TOXIC.

THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS MUST BE TAKEN WHEN USING CLEANING SOLVENTS.

Solvent must be kept in a spill-proof container and adequate ventilation must be provided when in use.

MEK, MIBK, and trichloroethane must not be used as the leak-path flushing cleaner.

5. Fillet Sealant Repair

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Viton sealant kit, for fillet sealing of leak area	Select from Table 801
Viton sealant kit, for final overcoating of leak area	Select from Table 801
RB Eurotwill cloth	-
Approved abrasive pad:	-
SCOTCHBRITE, fine grade S (William Canning Ltd., Great Hampton St., Birmingham 18, England.)	
Caulking gun, with cartridges and nozzles, for application of sealant	-
Hand tool, for removal, application and fashioning of sealant, including:	-
Fairing tool	
Cutting tool	
Removal tool	
Suitable bristle brush, for application of sealant	
Internal access mats, to protect fuel tank floor	-

B. Prepare to Repair Fillet Sealant

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Make a check-list of all items of equipment which will be taken into the tank.

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(3) Using the sealant cutting and removal tools (Ref. Fig. 802), carefully remove the defective section of fillet, working along the fillet in both directions until undamaged areas are reached.

(4) Taper the undamaged fillet at both ends of the defective area to make a scarf joint for the repair.

RB (5) Clean the exposed surface of the leak area, using cleaning solvent, applied with Eurotwill cloth.

(6) Lightly abrade the painted surface with fine grade Scotchbrite abrasive pad, wetted with MEK or MIBK.

RB (7) Using clean Eurotwill cloth, wipe the area dry before it air-dries.

(8) If the paint primer finish is damaged, repaint the primer surface as necessary (Ref. Cleaning/Painting).

C. Repair Fillet Sealant (Ref. Fig. 801)

(1) Clean the leak area with solvent immediately before the application of the first coat of sealant.

(2) Mix the Viton fillet sealant selected from Table 801.

(3) Fill the cartridge of the caulking gun (Ref. Fig. 802) with fillet sealant, taking care to avoid introducing air bubbles.

(4) Using the caulking gun, apply a thick coat of fillet sealant over the repair area to build it up to the same thickness as the rest of the fillet. Force the sealant ahead of the gun in the direction of the nozzle flow.

(5) Smooth out the applied sealant, using the fillet fairing tool (Ref. Fig. 802) to give the repair area the same profile as the rest of the fillet. Wipe the tool frequently to ensure a smooth fillet.

(6) Allow the fillet sealant to become tack-free.

(7) Mix the final Viton overcoating sealant selected from Table 801.

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(8) Apply a liberal brush-coat of final overcoating sealant to the repair area.

(9) Allow the final overcoating sealant to become tack-free.

D. Conclusion

(1) Refit any structure or equipment removed to carry out the repair.

(2) Remove all tools, equipment and cleaning materials from the tank. Check off every item on the check-list made when the equipment was taken into the tank.

CAUTION: ALL ITEMS ON THE CHECK-LIST MUST BE ACCOUNTED FOR BEFORE ACCESS PANELS ARE REFITTED.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Fit the access panels, removed to gain entry into the tank, as detailed in 53-00-00 and 57-00-00, Removal/Installation.

R (5) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

6. Fastener Sealant Repair, by Overcoating

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Viton sealant kit, for fillet sealing of leak area	Select from Table 801

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DESCRIPTION	PART NO.
Viton sealant kit, for final overcoating of leak area	Select from Table 801
RB Eurotwill cloth	-
Caulking gun, with cartridges and nozzles, for application of sealant	-
Hand tools, for removal and application of sealant:	-
Pliers	
Cutting tool	
Suitable bristle brush, for application of sealant	
Internal access mats, to protect fuel tank floor	-

B. Prepare to Repair Fastener Sealant

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Make a check-list of all items of equipment which will be taken into the tank.

(3) Using the sealant cutting tool (Ref. Fig. 802), cut around the base of the fastener (bolt or rivet) to remove the sealant from the structure.

(4) Using a pair of pliers, pull the sealant away from the fastener. This will remove most of the sealant.

(5) Cut away the remaining sealant with the cutting tool.

NOTE: Bolted fasteners can be checked for correct torque-tightening at this stage. Tightening after application of new sealant is not permitted.

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C. Repair Fastener Sealant (Ref. Fig. 801)

(1) Clean the leak area with solvent immediately before the application of the first coat of sealant.

(2) Mix the Viton sealant for fastener capping selected from Table 801.

(3) Fill the cartridge of the caulking gun (Ref. Fig. 802) with fastener capping sealant, taking care to avoid introducing air bubbles.

(4) Using the caulking gun, apply a thick coat of capping sealant over the fastener.

(5) Allow the capping sealant to become tack-free.

(6) Mix the final Viton overcoating sealant selected from Table 801.

(7) Apply a liberal brush-coat of final overcoating sealant over the fastener and adjacent area.

(8) Allow the final overcoating sealant to become tack-free.

D. Conclusion

(1) Refit any structure or equipment removed to carry out the repair.

(2) Remove all tools, equipment and cleaning materials from the tank. Check off every item on the check-list made when the equipment was taken into the tank.

CAUTION: ALL ITEMS ON THE CHECK-LIST MUST BE ACCOUNTED FOR BEFORE ACCESS PANELS ARE REFITTED.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

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R (4) Fit the access panels, removed to gain entry into the tank, as detailed in 53-00-00 and 57-00-00, Removal/Installation.

R (5) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

7. Interfay Sealant Repair, by Hollow Bolt Injection (Ref. Fig. 803)

A. General

Repairs to pre-packed or faying surface seals may necessitate the dismantling of structure and fasteners, in which case reference must be made to the Structural Repair Manual. Alternatively, these seals can be repaired by the hollow-bolt injection procedure detailed below and/or raising the seal plane around the failed seal to isolate it completely from the fuel.

The illustrations (Ref. Fig. 804, 805 and 806) and (Ref. Fig. 807) show details of specific structural joints in the tanks at frame 42 and spars 47, 60 and 63. 'Tunnels' in the joints, formed by multiple-plate assemblies, can be re-sealed by removing the standard sealing bolts and using the hollow-bolt injection procedure.

B. Equipment and Materials

	DESCRIPTION	PART NO.
	Cleaning solvent	Select from Table 802
R	Polysulphide sealant kit, for injection sealing of leak area.	Select from Table 801
	Viton sealant kit, for final overcoating of leak area	Select from Table 801
RB	Eurotwill cloth	-
B B	BA Concorde Fuel Tank Leak Repair Kit (Injection gun, and accessories	3-BA 19469

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DESCRIPTION	PART NO.
Hand tools, for removal of sealant and swarf:	-
Cutting tool	
Removing tool	
Suitable bristle brush, for application of sealant	
Internal access mats, to protect fuel tank floor	-

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C. Prepare to Repair Interfay Sealant

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Make a check-list of all items of equipment which will be taken into the tank.

(3) Remove one, or not more than three, fasteners (bolts or rivets) from the joint where the leak occurs.

NOTE: For removal of fasteners other than standard sealing bolts, reference must be made to the Structural Repair Manual.

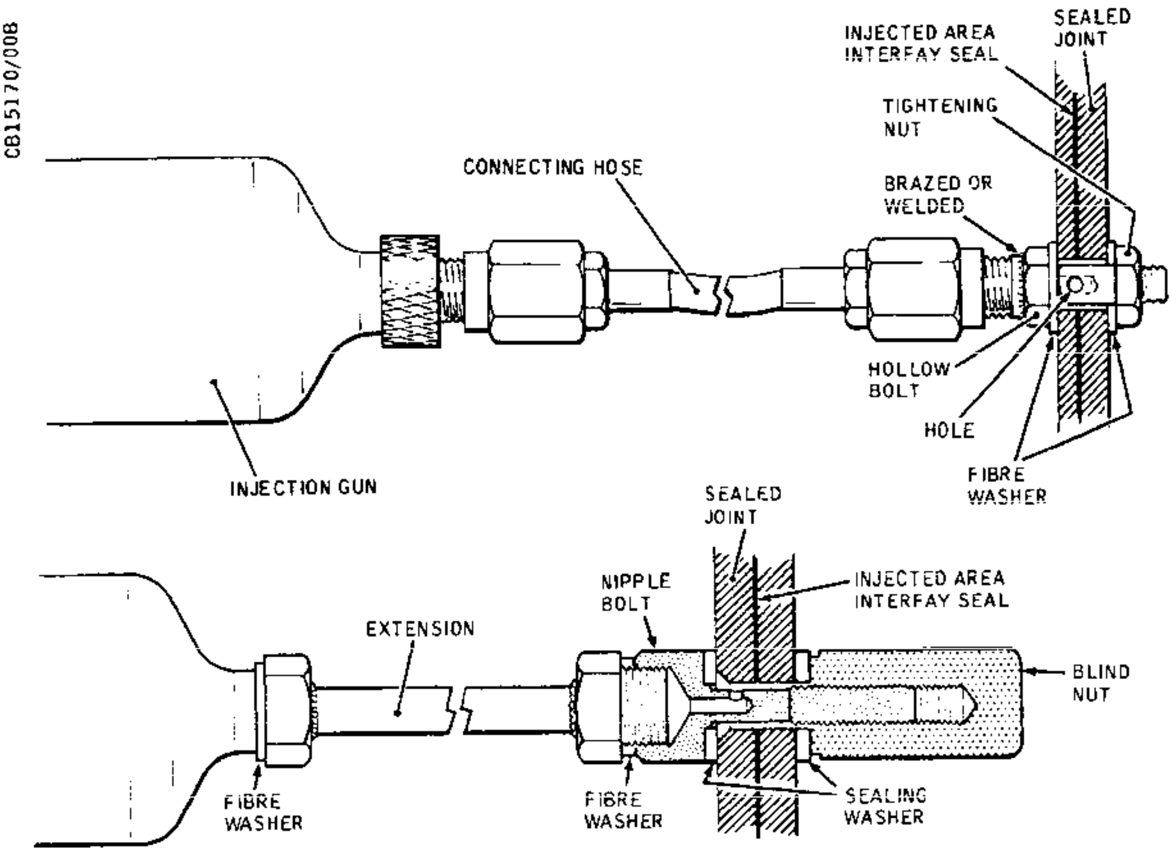
For skin lap joints, rivets may be removed over a maximum length of 10 in (254 mm).

The skin joints must be separated with non-metallic or soft aluminium wedges, unless separation can be achieved by sealant injection.

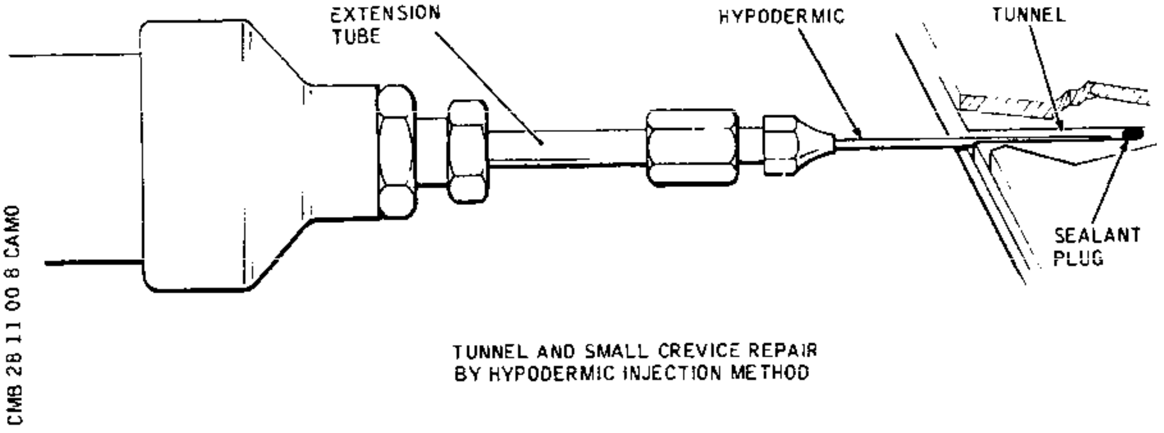
(4) Using the hand tools, remove all swarf and loose sealant.

(5) Replace each removed fastener with a special hollow bolt, and spacer if required, to suit the diameter of the hole and of the appropriate length for the thickness of the joint. Ensure, by use of washers, that the injection hole in the bolt is as close as possible to the interfay joint.

(6) Tighten the bolt only as far as is necessary to provide a seal.

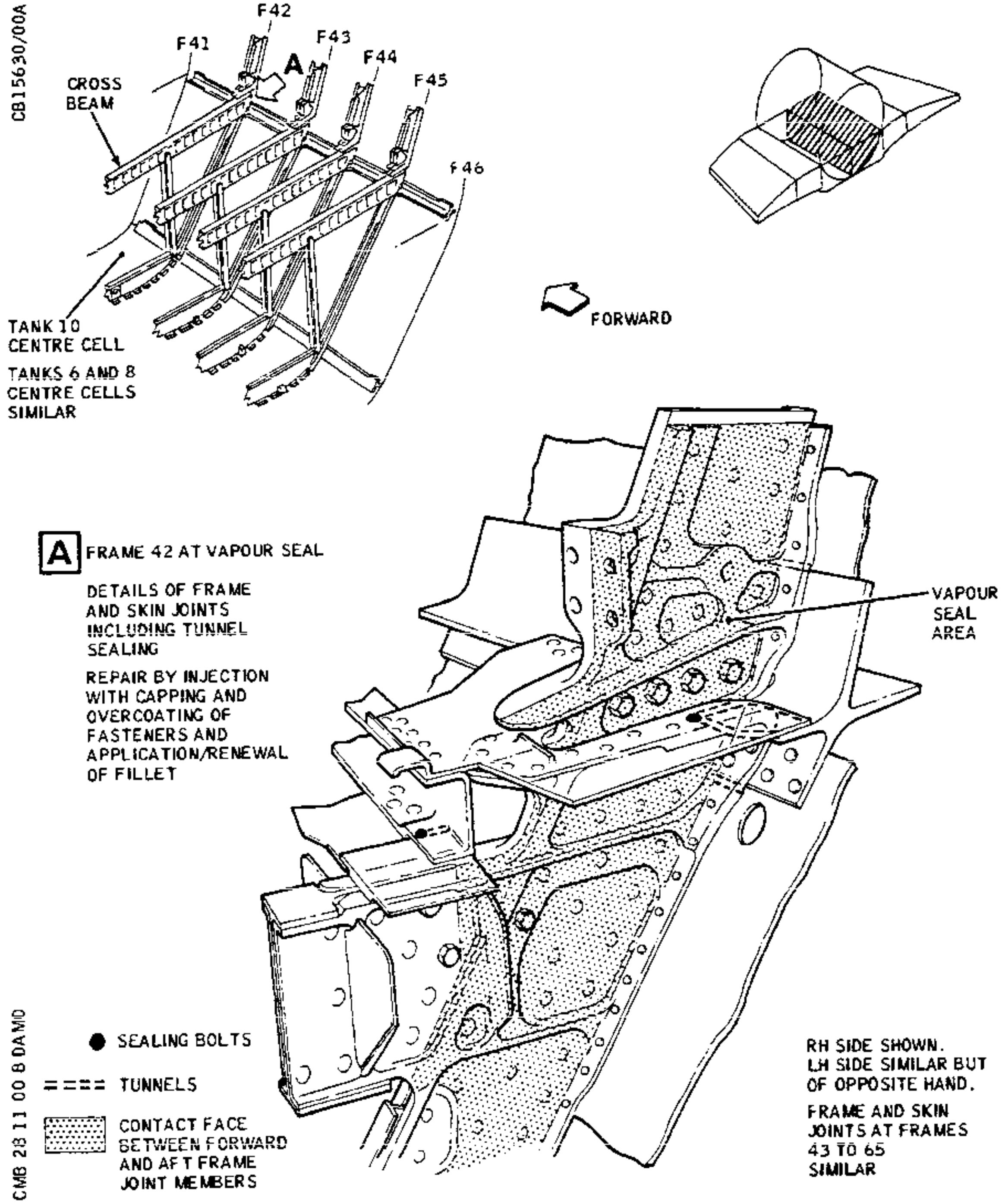


INTERFAY SEAL REPAIR BY NIPPLE BOLT INJECTION METHOD

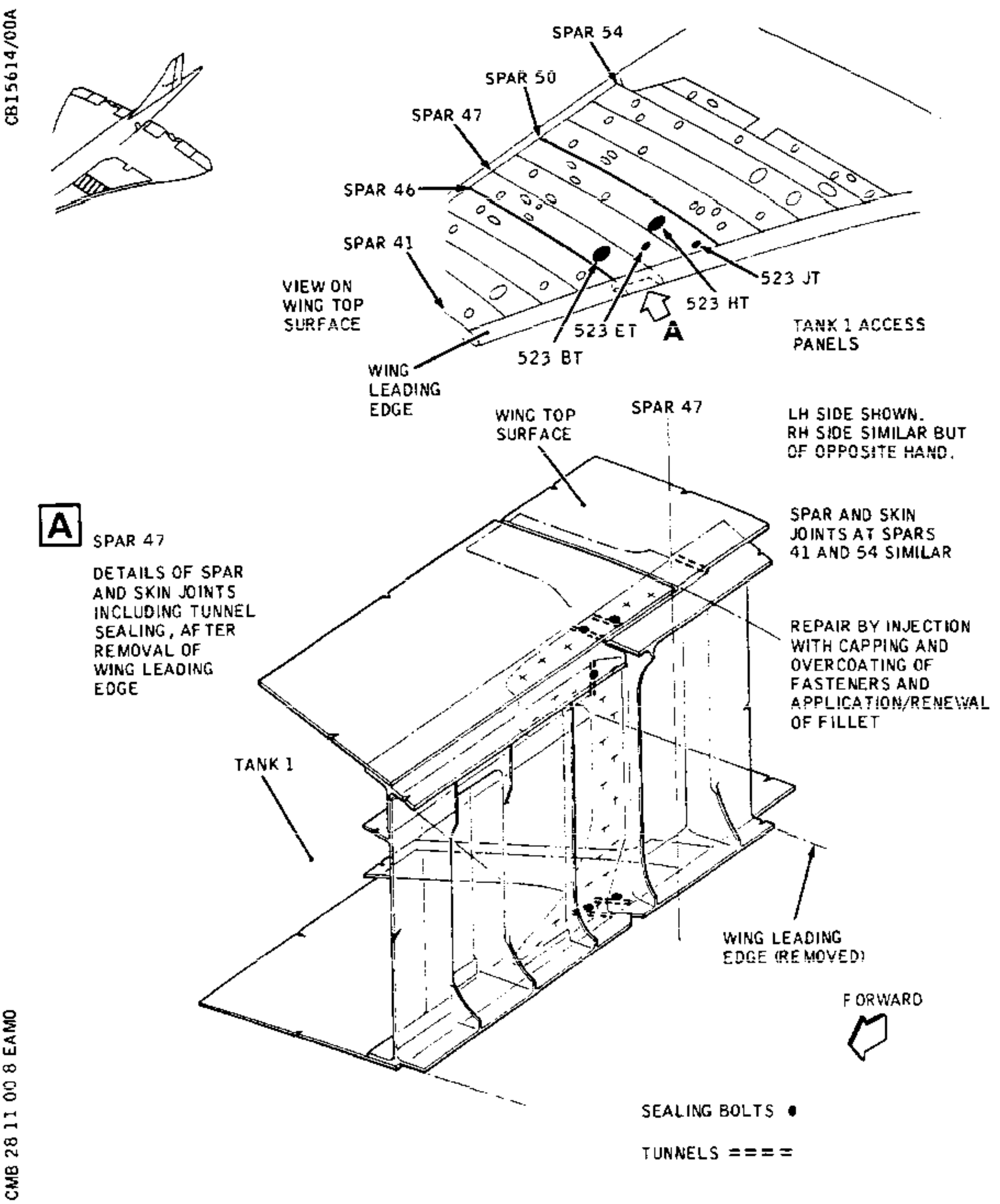


TUNNEL AND SMALL CREVICE REPAIR BY HYPODERMIC INJECTION METHOD

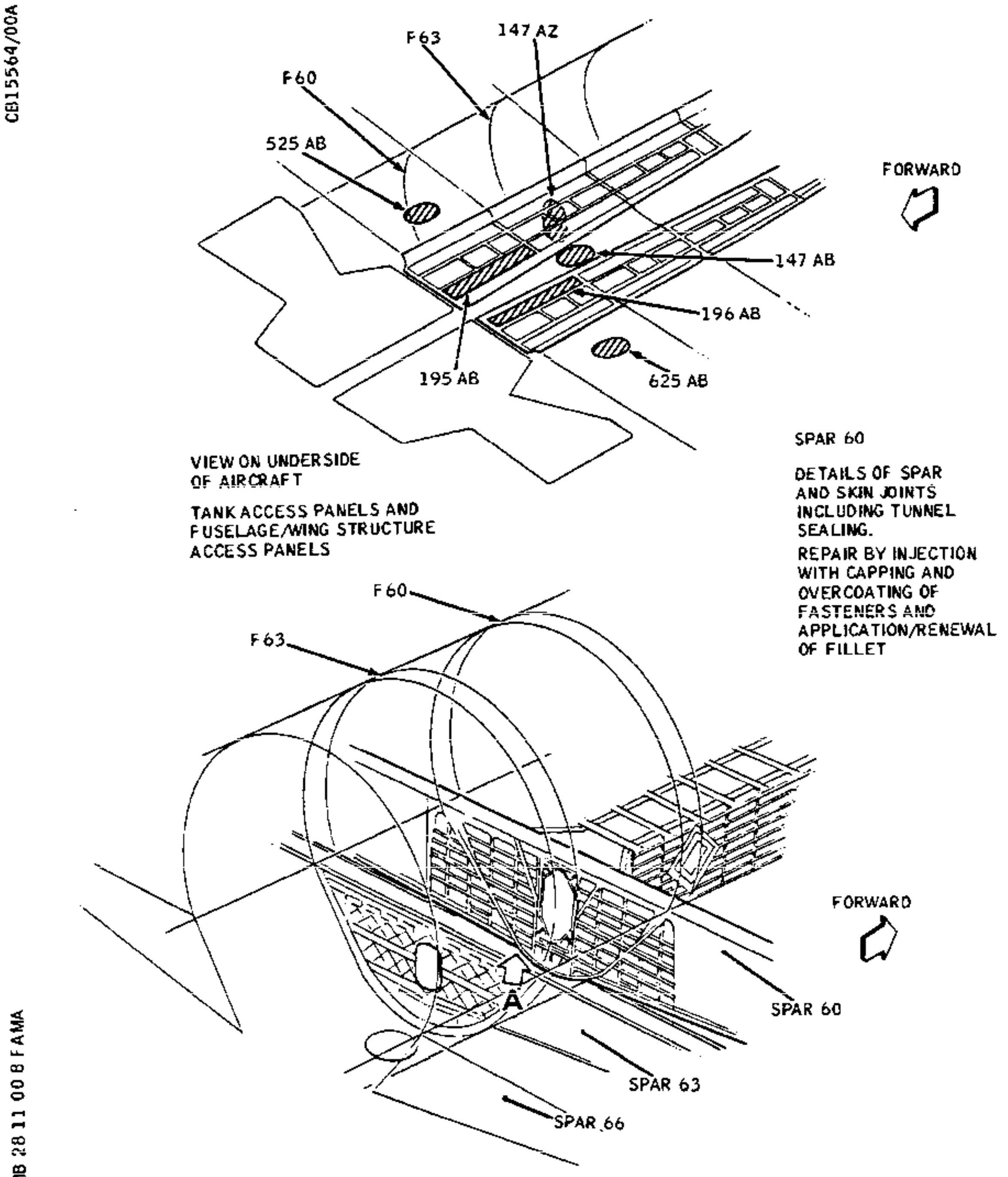
R - Injection Gun and Accessories - Typical
Figure 803



- Frame 42 Structural Joints at Vapour Seal
R Figure 804

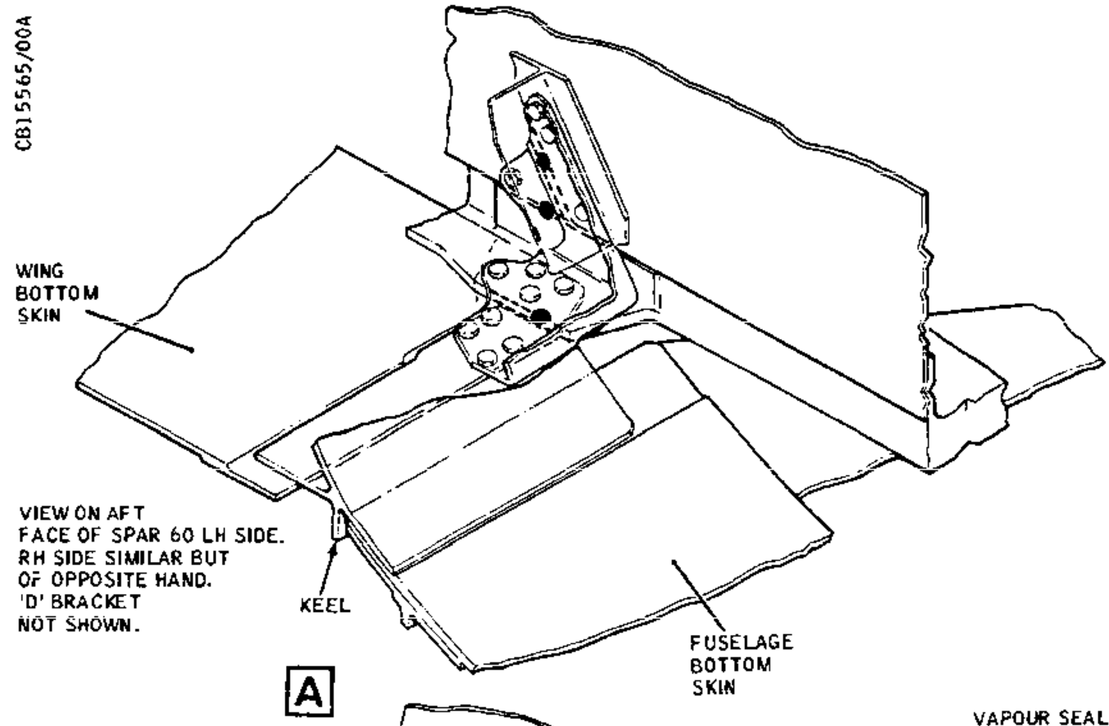


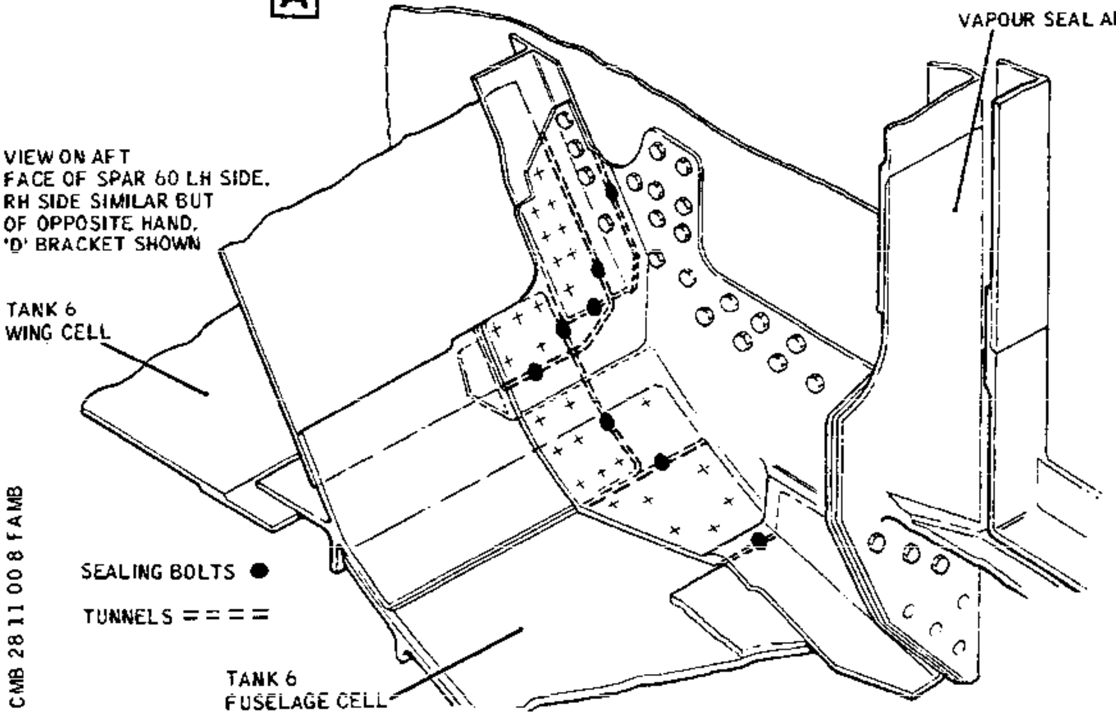
- Spar 47 Structural Joints at Leading Edge
R Figure 805



\- Spar 60 Structural Joints at Keel Intersection
(Sheet 1 of 2)
Figure 806

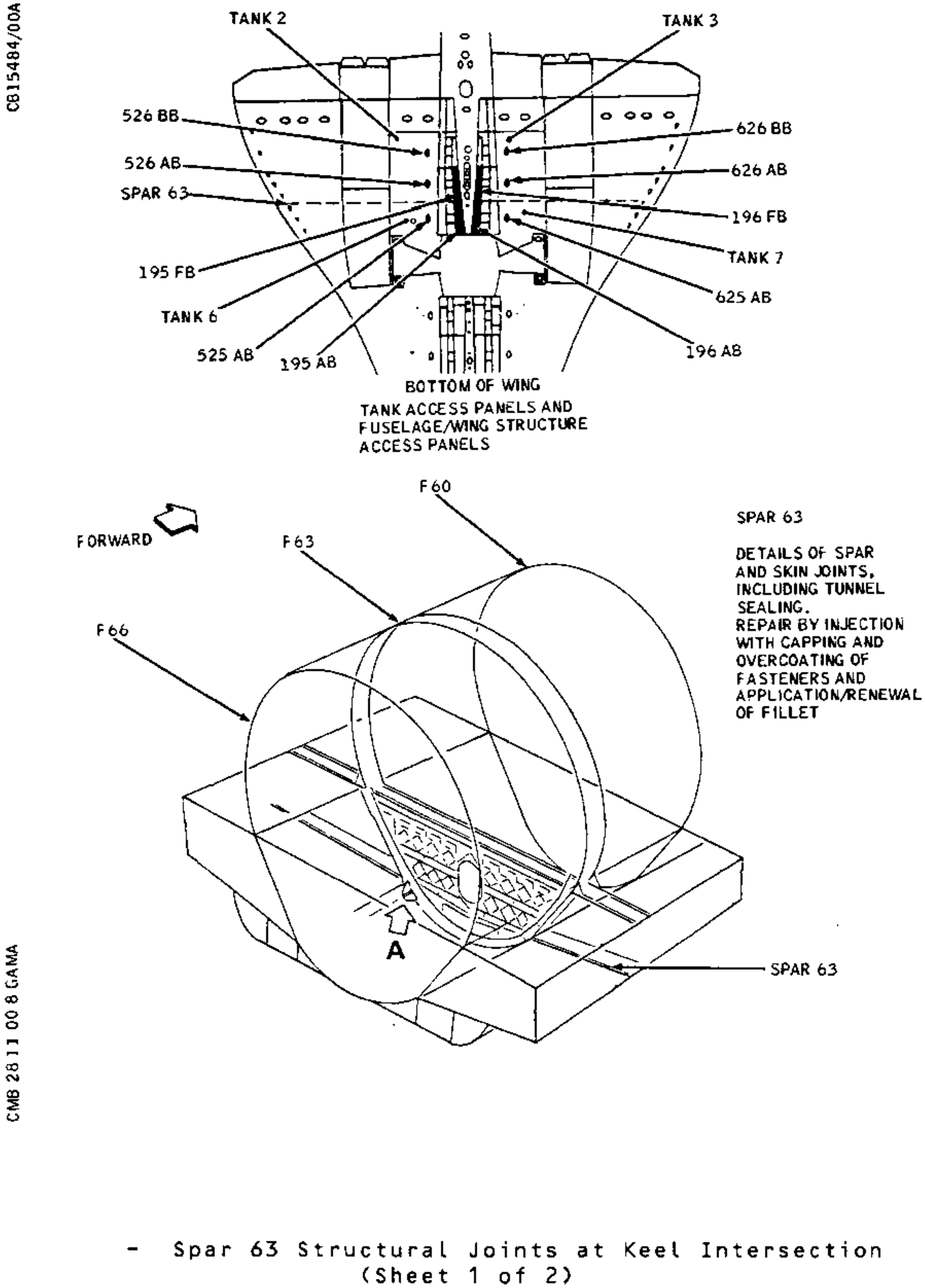
R





- Spar 60 Structural Joints at Keel Intersection
(Sheet 2 of 2)
Figure 806

R



- Spar 63 Structural Joints at Keel Intersection
(Sheet 1 of 2)
R Figure 807

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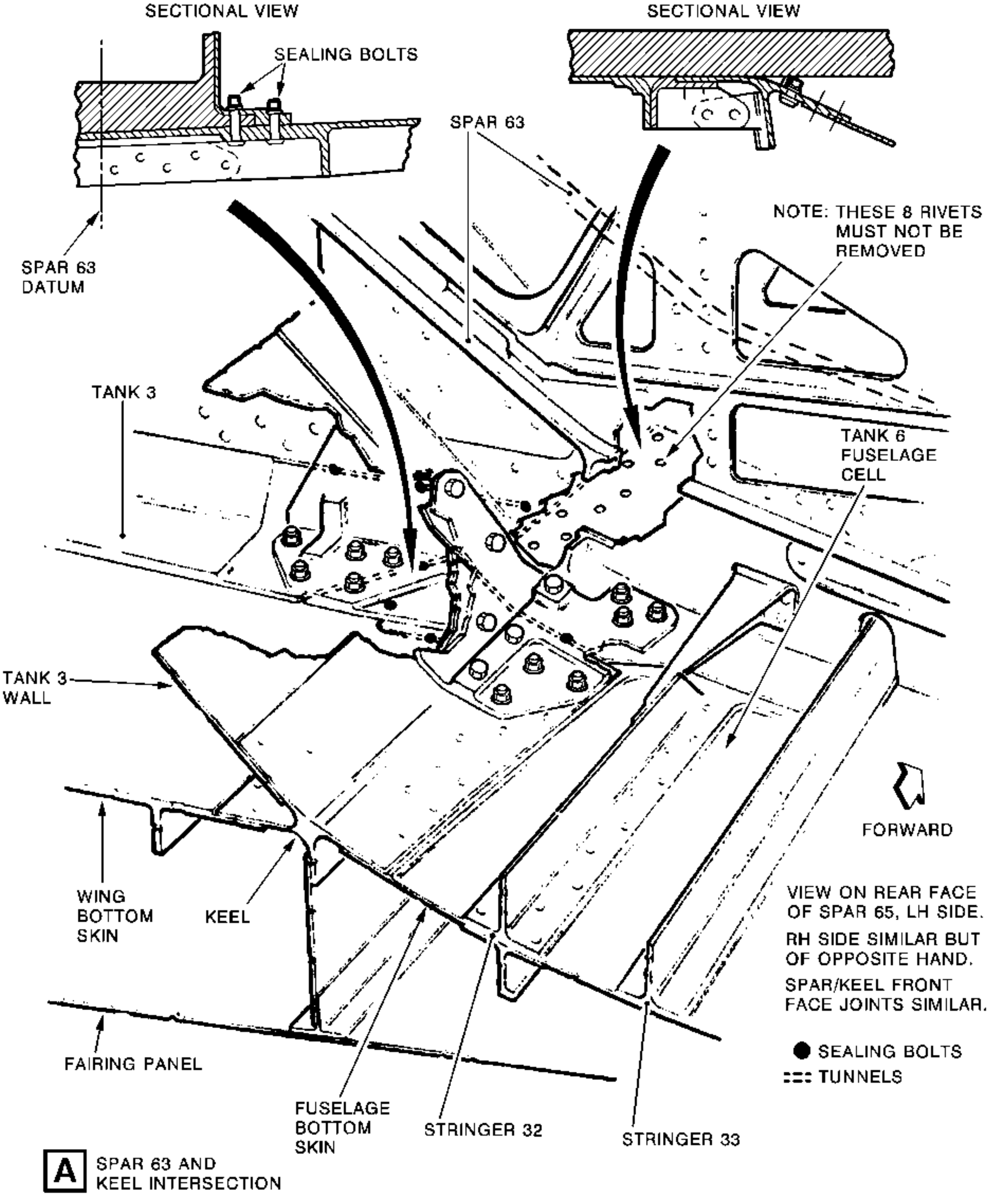

Spar 63 Structural Joints at Keel Intersection
(Sheet 2 of 2)
Figure 807

(7) Using the injection gun, fitted to the hollow bolt, flush through the leak path with cleaning solvent.

NOTE: Only halogenated hydrocarbon solvent R.113 is to be used for flushing the leak path.

(8) Remove the gun and wipe the joint area, using clean, dry,
RB Eurotwill cloth.

D. Repair Interfay Sealant

(1) Select a suitable polysulphide sealant (Ref. Table 801). Mix a sufficient quantity and load the gun. Carry out a degassing process (Ref. 20-22-22) before use.

(2) Fit the gun to the hollow bolt.

(3) Operate the gun, at the lowest pressure needed to maintain a flow of sealant, until the sealant is seen to exude from the joint. Release the pressure immediately.

NOTE: Up to 30 min may be required for penetration of some complex joints.

(4) Remove the gun hollow bolt.

(5) Repeat the operation at all removed fastener positions.

(6) Fit final fasteners and, in the case of bolts, torque-tighten them in accordance with the Structural Repair Manual within the application life of the sealant (Ref. Table 801).

NOTE: Titanium rivets should be replaced with monel rivets (Ref. Structural Repair Manual, 51-51-00).

(7) Allow the sealant to dry to a tack-free condition.

(8) Renew fillets and fastener capping where removed (Ref. paras.4 and 5).

(9) Mix the final Viton overcoating sealant selected from Table 801.

(10) Apply a liberal brush-coat of final overcoating sealant to the joint area, ensuring that all exposed polysulphide sealant is overcoated with Viton.

(11) Allow the final overcoating sealant to become tack-free.

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E. Conclusion

(1) Refit any structure or equipment removed to carry out the repair.

(2) Remove all tools, equipment and cleaning materials from the tank. Check off every item on the check-list made when the equipment was taken into the tank.

CAUTION: ALL ITEMS ON THE CHECK-LIST MUST BE ACCOUNTED FOR BEFORE ACCESS PANELS ARE REFITTED.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Fit the access panels, removed to gain entry into the tank, as detailed in 53-00-00 and 57-00-00, Removal/Installation.

R (5) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

8. Tunnel Sealant Repair, by Hypodermic Injection (Ref. Fig. 803)

A. General

This repair method may be used to reseal 'tunnels' in the structure, formed by multiple-plate assembly as shown in the illustrations. Application of sealant by this method is particularly suitable for repairing structural joints in tank 11 (Ref. Fig. 808). Penetration into the tunnel is effected by the use of an injection gun fitted with a hypodermic needle.

B. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Polysulphide sealant kit, for injection sealing of leak area	Select from Table 801

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DESCRIPTION	PART NO.
Viton sealing kit, for final overcoating of leak area	Select from Table 801
Void filler sealant (Ref. 20-30-00, No.381)	EC3524
Eurotwill cloth	-
Injection gun, hypodermic needle and accessories	-
Hand tools, for removal, application and fairing of sealant, including:	-
Fairing tool	
Cutting tool	
Removal tool	
Suitable bristle brush, for application of sealant	
Internal access mats, to protect fuel tank floor	-

C. Prepare to Repair Tunnel Sealant

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Make a check-list of all items of equipment which will be taken into the tank.

(3) Remove the faulty fillet sealing around the area of the tunnel (Ref. para.4.).

Before SB 53-024

(4) If necessary, remove local fasteners and combine the hollow bolt injection procedure (Ref. para.6.) with the procedure which follows.

<u>NOTE</u>: For removal of fasteners other than standard sealing bolts, reference must be made to the Structural Repair Manual.

After SB 53-024 For A/C 001-005,

(4) If necessary, remove local fasteners, extra sealing

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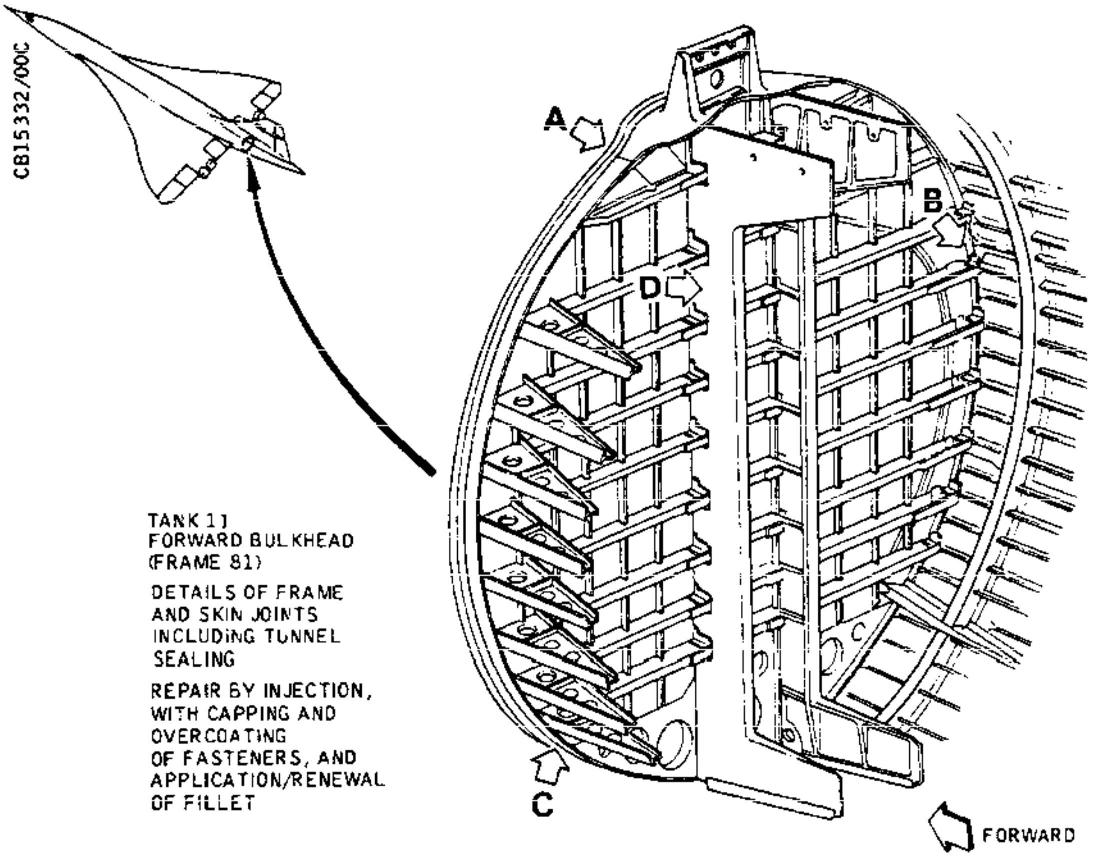
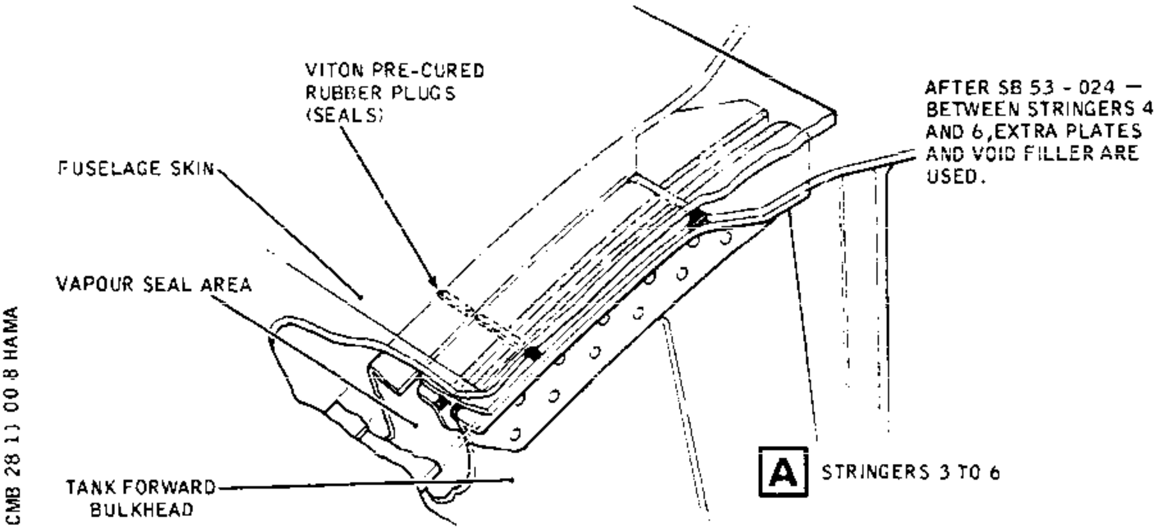
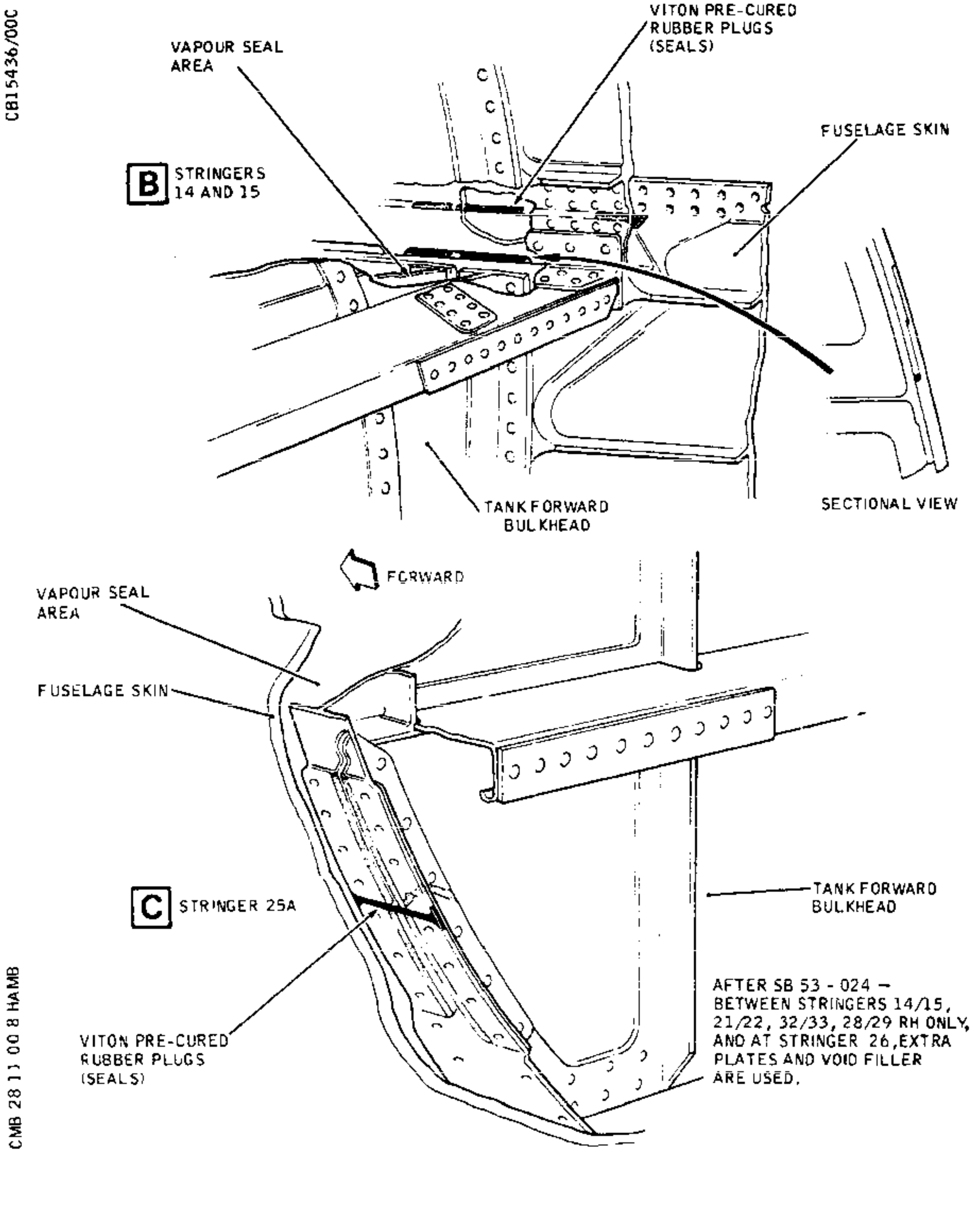




\- Tank 11 Forward Bulkhead Structural Joints
(Sheet 1 of 3)
Figure 808

R



\- Tank 11 Forward Bulkhead Structural Joints
(Sheet 2 of 3)
Figure 808

R

plates with void filler where fitted, and combine the hollow bolt injection procedure (Ref. para.6.) with the procedure which follows.

NOTE: For removal of fasteners other than standard sealing bolts, reference must be made to the Structural Repair Manual.

(5) Using the injection gun, fitted with a hypodermic needle, flush the tunnel and surrounding area with cleaning solvent.

NOTE: Only halogenated hydrocarbon solvent R.113 is to be used for flushing the tunnel.

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(6) Remove the gun and wipe the area, using clean, dry,
RB Eurotwill cloth.

D. Repair Tunnel Sealant

(1) Select a suitable polysulphide sealant (Ref. Table 801). Mix a sufficient quantity and load the gun. Carry out a degassing process (Ref. 20-22-22) before use.

(2) Insert the hypodermic needle into the tunnel and operate the gun, at the lowest pressure needed to maintain a flow of sealant, until the sealant exudes at the tunnel entry.

(3) Withdraw the needle, with sealant still exuding, to fill the tunnel completely.

Before SB 53-024

(4) Fit final fasteners, if removed, and, in the case of bolts, torque-tighten them in accordance with the Structural Repair Manual within the application life of the sealant (Ref. Table 801).

NOTE: Titanium rivets should be replaced with monel rivets (Ref. Structural Repair Manual, 51-51-00).

After SB 53-024 For A/C 001-005,

(4) Fit extra sealing plates, using void filler in accordance with 20-25-23 with final fasteners, if removed, and, in the case of bolts, torque-tighten them in accordance with Structural Repair Manual within the application life of the sealant (Ref. Table 801).

NOTE: Titanium rivets should be replaced with monel rivets (Ref. Structural Repair Manual, 51-51-00).

(5) Allow the sealant to dry to a tack-free condition.

(6) Renew fillets and fastener capping where removed (Ref. para.4 and 5).

(7) Mix the final Viton overcoating sealant selected from Table 801.

(8) Apply a liberal brush-coat of final overcoating sealant to the joint area, ensuring that all exposed polysulphide sealant is overcoated with Viton.

(9) Allow the final overcoating sealant to become tack-free.

E. Conclusion

(1) Refit any structure or equipment removed to carry out the repair.

(2) Remove all tools, equipment and cleaning materials from the tank. Check off every item on the check-list made when the equipment was taken into the tank.

CAUTION: ALL ITEMS ON THE CHECK-LIST MUST BE ACCOUNTED FOR BEFORE ACCESS PANELS ARE REFITTED.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Fit the access panels, removed to gain entry into the tank, as detailed in 57-30-20, Removal/Installation).

R (5) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

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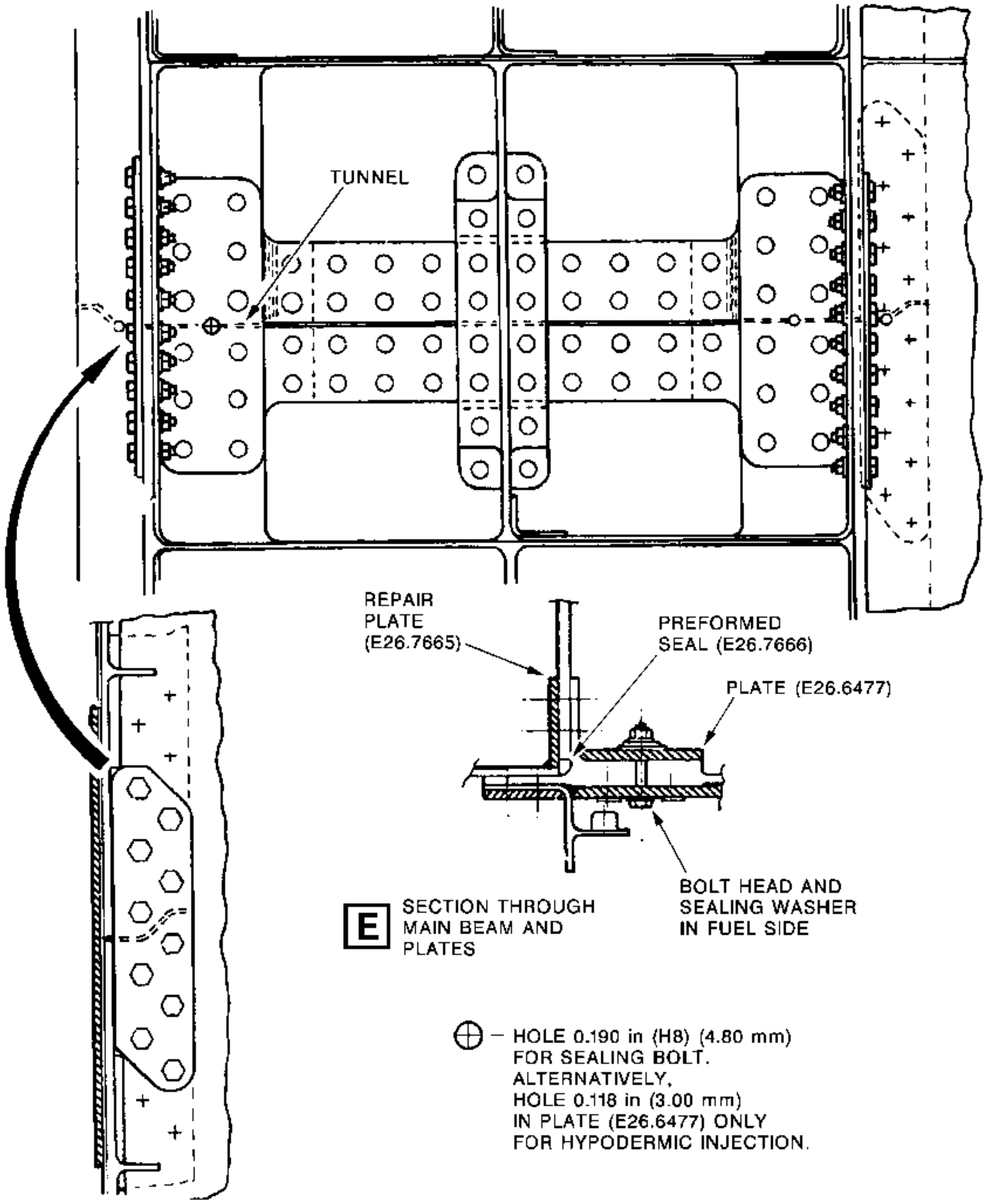

D REPAIR TO TOP BULKHEAD FRAME 81 CENTRE FITTING LH AND RH (MOD.2048)

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Tank 11 Forward Bulkhead Structural Joints
(Sheet 3 of 3)
Figure 808

9. Tank 11 Top Bulkhead Centre Fitting Repair (LH and RH, Frame 81) (Ref. Fig. 808) (Sheet 3)

NOTE: The following procedure is used to repair a fuel leak that may occur at tank 11 forward bulkhead.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Polysulphide sealant kit, for injection sealing of leak area	Select from Table 801
Viton sealant kit, for final overcoating of leak area	Select from Table 801
RB Eurotwill cloth	-
Injection gun and accessories	-
Hand tools, for removal and application of sealant:	-
Cutting tool	
Removal tool	
Fairing tools	
Suitable bristle brush, for application of sealant	
Internal access mats, to protect fuel tank floor	-
Drill and reamer, for 0.190 in (H8) (4.80 mm)hole, or alternatively,	-
Drill, for 0.118 in (3.00 mm) hole	-
Torque spanner, 31 to 40 lbf in (0.350 to 0.452 mdaN)	-

B. Prepare to Repair Frame 81 Centre Fitting, LH and RH

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Open the service compartment door 153 FB to gain access to the front of tank 11.

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C. Repair Frame 81 Centre Fitting, LH and RH

(1) Remove and retain the nuts and bolts securing the plates (E266476) to the main beams.

(2) Remove and discard the plates.

(3) Remove sealants from the area of the repair (Ref. para.4.).

(4) Add sealant to the tunnels by either of the following methods (a) or (b), as convenient.

(a) Use the hollow bolt injection method, as follows:

a1) Drill and ream a 0.190 in (H8) (4.80 mm) hole, in accordance with 20-21-23, through the joint assembly where indicated.

a2) Using the hollow bolt method (Ref. para.6.), inject sealant into the tunnel.

a3) From inside the tank, fit the sealing bolt (BAS 908-3-16) with the sealing washer (BAC 7181-03). From outside the tank, fit the plain washer (AN 960-10) and nut (BAS 7031-3). Torque-tighten the nut to between 31 and 40 lbf in (0.350 to 0.452 mdaN).

a4) Encapsulate the bolt-head and nut with sealant (Ref. para.5.).

(b) Use the hypodermic injection method as follows:

b1) Drill a 0.118 in (3.00 mm) hole, where indicated, in the plate (E266477) only. Plate thickness is 0.21 in (5.334 mm).

b2) Using the hypodermic needle (Ref. para.7.), inject sealant into the tunnel.

(5) Assemble the preformed seal and repair plate, with the nuts and bolts previously removed, in accordance with 20-22-12.

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D. Conclusion

(1) Remove all tools, equipment and cleaning materials from the tank. Ensure that the tank is clean and free from debris.

(2) Ensure that the mating faces of the tank access panel and structure are clean.

R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Fit a new door seal, lubricated with petroleum jelly.

R (5) Refit the panel as follows:

(a) Simultaneously, insert the door bolts from the LH and RH sides of the door and progressively work toward the centre. Hand-tighten the bolts in the same procedure.

(b) Alternatively, working from the LH and RH sides of the door and progressively toward the centre, torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(c) Repeat the above operation (b), but torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

R (6) Check that the electrical resistance between the panel and adjacent structure is in accordance with 20-27-11.

R (7) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

R (8) Close and secure the service compartment door 153 FB

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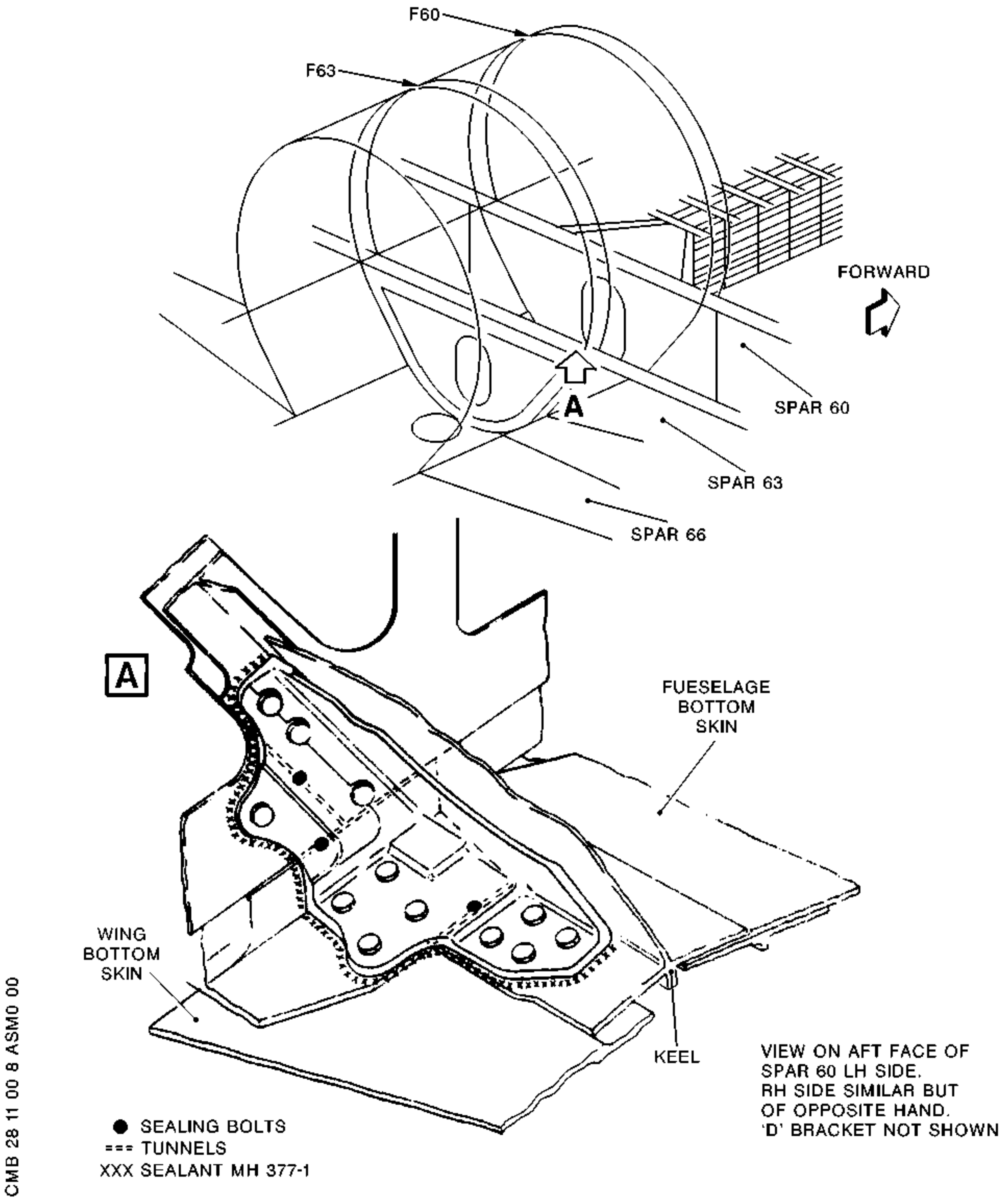

Typical Temporary Repair - Internal
Figure 809

10. Temporary Internal Repair (Ref. Fig. 809)

NOTE: This repair procedure uses an alternative compound to that used in other procedures in this topic.

The compound, epoxide resin MH377-1, has a short pot-life (5 to 10 min) with a high degree of curing being achieved in 1 h at 20 deg C.

The compound is used in a single application, to encapsulate/overcoat all types of fasteners, and provide a fillet seal at structure/component joints.

This procedure is a temporary alternative to other procedures in this topic. When convenient, the normal repair procedures must be carried out.

The estimated life of the repair is between 500 and 1,500 flying hours.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvents:	-
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	
Trichlorethane (Baltane) (Ref. 20-30-00, No.485)	
Sealing compound MH377-1:	-
RUTAPOX VE251 - Parts A and B RUTAPOX 0256 - Plasticizer (Bakelite GMBH, Docteur J. Moisson, 17 Avenue des Chardonnerets, Le Sous-Biscain, 60340 Villers-sous-Saint-Leu, France.)	
AEROSIL colloidal silica (DEGUSSA France S.A.R.L., 157 Avenue Charles de Gaulle, B.P. 125, 92203 Neuilly-sur-Seine, France.)	

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DESCRIPTION	PART NO.
Hand tools, for removal and application of sealant:	-
Cutting tool	
Removal tool	
Fairing tools	
Injection gun and accessories	-
Approved abrasive pad:	-
SCOTCHBRITE, fine grade S	
RB Eurotwill cloth	-

B. Prepare for Internal Temporary Repair

(1) Prepare for entry into the tank (Ref. 28-10-00), observing the safety precautions.

(2) Make a check-list of all items of equipment which will be taken into the tank.

(3) Using the sealant cutting and removal tools (Ref. Fig. 802), carefully remove the defective areas of sealant.

RB (4) Thoroughly clean the area to be repaired with the abrasive pad and trichlorethane-soaked Eurotwill cloth.

(5) Inject trichlorethane into the leak path.

<u>WARNING</u>: 'MEK' IS FLAMMABLE AND TOXIC. TAKE ALL NECESSARY PRECAUTIONS WHEN USING SOLVENTS.

(6) Using MEK, finally degrease the repair area and blow dry with filtered compressed air.

C. Repair

(1) prepare and mix the compound MH377-1 in accordance with 20-22-31.

(2) Using the spatula, apply the compound as a fillet around the structure/component joint and/or encapsulate the affected fasteners.

(3) Allow the compound to cure for 1 h.

D. Conclusion

(1) Remove all tools, equipment and materials from the tank. Ensure that the tank is clean and free from debris.

(2) Check off every item on the check-list made when the equipment was taken into the tank.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Refit the tank access panel.

R (5) Carry out the Tank Acceptance Test (Ref. Adjustment/Test).

11. Temporary External Repair - Method 1 (Epoxide Resin MH377-1)

NOTE: This repair uses an epoxide resin compound MH377-1 for exterior temporary repairs. This compound has proved to be a more satisfactory sealant than others used to date.

When convenient, the normal repair procedures must be carried out.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvents:	-
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	
Trichlorethane (Baltane) (Ref. 20-30-00, No.485)	

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DESCRIPTION	PART NO.
Sealing compound MH377-1: RUTAPOX VE251 - Parts A and B RUTAPOX 0256 - Plasticizer (Bakelite GMBH, Docteur J. Moisson, 17 Avenue des Chardonnerets, Le Sous-Biscain, 60340 Villers-sous-Saint-Leu, France). AEROSIL colloidal silica (DEGUSSA France S.A.R.L., 157 Avenue Charles de Gaulle, B.P. 125, 92203 Neuilly-sur-Seine, France.)	-
Hand tools, for removal and application of sealant: Cutting tool Removal tool Fairing tools	-
Approved abrasive pad: SCOTCHBRITE, fine grade S (William Canning Ltd., Great Hampton Street, Birmingham 18, England.)	-
Lint-free cleaning tissues	
Filtered compressed air	

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B. Prepare for External Repair

NOTE To obviate the need for defuelling, fuel must be repelled from the leak area by the continuous use of filtered compressed air.

(1) Using the abrasive pad or removal tools, remove as required:

(a) the paint finish down to the primer paint or bare metal,

(b) previously applied resin MH377-1, partially or completely, or,

(c) any other materials used for sealing, completely.

(2) Degrease the area, using trichlorethane-soaked tissues

WARNING: 'MEK' IS FLAMMABLE AND TOXIC. TAKE ALL NECESSARY PRECAUTIONS WHEN USING SOLVENTS.

(3) Finally degrease the area with MEK and blow dry with filtered compressed air.

(4) Continue to repel fuel from the leak area, using filtered compressed air.

C. Repair

NOTE: The compound MH377-1 has a short pot-life (5 to 10 min), with a high degree of curing being achieved in 1 h at 20 deg C.

(1) Prepare and mix the compound MH377-1 in accordance with 20-22-31.

(2) Using the spatula, apply the compound in layers over the area to be sealed.

NOTE: The layers should be applied to form as smooth a contour as possible.

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(3) Continue to blow filtered compressed air over the repair area for not less than 10 min.

D. Conclusion

(1) Check, for a period of not less than 10 min, that the fuel leak has been stopped. If not, repeat the above procedure.

(2) Remove all tools and equipment from the working area.

12. Temporary External Repair - Method 2 ('Stop-a-leak' and 'Oyltite Stick')

NOTE: An outside stopper may be applied to stop an external leak temporarily. This temporary repair must be inspected after each flight.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Temporary stopper:	-
STOP-A-LEAK (Nine L Enterprises, 570 Blvd. Queen Ann Bldg., Revere, Mass. 02151, U.S.A.) (Code 27721)	
OYLTITE STICK (Lake Chemical Co., 250 N. Washenaw Ave., Chicago, Illinois 60612, U.S.A.) (Code 08854)	
Adhesive tape:	
VINYL BLANC - AUTOCOLLANT	Fascal 900 Blanc

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DESCRIPTION	PART NO.
(Fasson U.K. Products, 18 Frogmore Road, Apsley, Hemel Hempstead, Herts., U.K. HP3 9RT) (Code K6797) (Organisation de Vente des Produits Fasson, S.A.R.L., Zone Industrielle du Coudray, Rue Isaac Newton, 93155 Le Blanc, Mesnil, France.) (Fasson Division of Avery Products Corp., 250 Chester Street, Painesville, Ohio 44077, U.S.A.) (Code 22460)	

B. Repair, by Stopper

(1) Clean the leak area thoroughly, using a cleaning solvent.

(2) Immediately apply the temporary stopper to crevices and fasteners in accordance with the manufacturer's instructions.

(3) Apply an approved adhesive tape to extend the life of the repair.

R 13. Temporary External Repair - Method 2 ('Stop-a-leak' or
B 'Oyltite Stick' or Epoxy 615)

B CAUTION: SUSPECTED STRUCTURAL DAMAGE MUST BE INVESTIGATED
B AND ALL NECESSARY ACTION TAKEN BEFORE SEALANT
B REPAIRS, EITHER TEMPORARY OR PERMANENT, ARE MADE.

B OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00.

B OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

B Temporary repairs must be carried out whenever possible to
B reduce the leakage to a minimum, irrespective of the leak
B category or permissible leak rate. The necessary information

R B regarding the leak categories and action to be taken is
R B defined in Maintenance Manual.

R B The methods listed below are suitable for application to
R B the external surface only.

NOTE: An outside stopper may be applied to stop an external leak temporarily. This temporary repair must be inspected after each flight.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Temporary stopper:	-
STOP-A-LEAK (Nine L Enterprises, 570 Blvd. Queen Ann Bldg., Revere, Mass. 02151, U.S.A.) (Code 27721)	
OYLTITE STICK (Lake Chemical Co., 250 N. Washtenaw Ave., Chicago, Illinois 60612, U.S.A.) (Code 08854)	
Adhesive tape:	-
VINYL BLANC - AUTOCOLLANT (Fasson U.K. Products, 18 Frogmore Road, Apsley, Hemel Hempstead, Herts., U.K. HP3 9RT) (Code K6797) (Organisation de Vente des Produits Fasson, S.A.R.L., Zone Industrielle du Coudray, Rue Isaac Newton, 93155 Le Blanc, Mesnil, France.) (Fasson Division of Avery Products Corp.,	Fascal 900 Blanc

DESCRIPTION	PART NO.
250 Chester Street, Painesville, Ohio 44077, U.S.A.) (Code 22460)	
B Epoxy 615	Code No.MAGC 0421

B. Repair, by Stopper

(1) Clean the leak area thoroughly, using a cleaning solvent.

(2) Immediately apply the temporary stopper to crevices and fasteners in accordance with the manufacturer's instructions.

(3) Apply an approved adhesive tape to extend the life of the repair.

B C. Repair, by Epoxy 615

B (1) After locating and defining the leak rate drain
B off fuel from tank.

B (2) Clean the leak area thoroughly with Genklene.

B (3) Dry the affected area with compressed air.

B (4) Mix and apply a coating of Epoxy 615 (Code No.
B MAGC 0421) in accordance with the manufacturer's
B instructions.

B (5) Check that the rectification action has cured
B the leak.

R 14. O-ring Seal Renewal (Ref. Fig. 810)

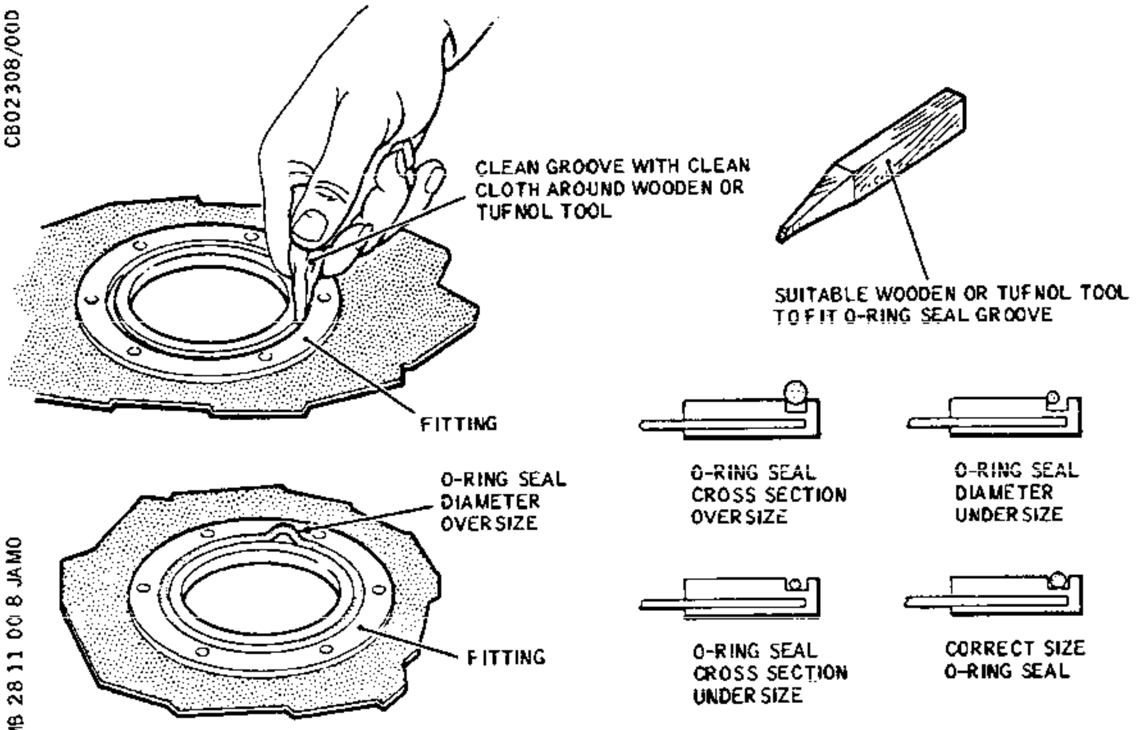
NOTE: The O-ring seals are those used to seal removable plumbing fittings and fuel system components which penetrate tank walls.

For O-ring seal renewal on fuel tank access doors and panels, refer to 57-30-20, Removal/Installation.

A. Equipment and Materials

DESCRIPTION	PART NO.
Cleaning solvent	Select from Table 802
Wooden or Tufnol tool, for cleaning groove	-

CB02308/000D



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- O-ring Seal Renewal
Figure 810

B. Renew O-ring Seal

(1) Remove the appropriate component(s) and the faulty O-ring seal.

(2) Clean the O-ring groove and mating surfaces of the components with cleaning solvent. Apply the solvent with a clean, lint-free cloth, wrapped around a

suitably shaped piece of wood or Tufnol. Ensure that all traces of sealant are removed.

(3) Lubricate a serviceable O-ring in accordance with 20-23-11 (unless the component installation instructions require the use of sealant), insert it into the groove and check that it fits the groove correctly.

(4) Install, in accordance with the appropriate instructions, the component(s) previously removed.

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15. Tank-wall Electrical Connectors - Renewal

For renewal of tank wall connectors, refer to Wiring Diagram Manual 20-42-54.

RB 16. British Airways Concorde Fuel Leak Rectification

RB A. Introduction

RB (1) This section of the Maintenance Manual is set up to present details of specific fuel leaks found on the BA aircraft and to detail the locations where rectification proved successful. In addition guidance material on some of the aspects of investigation is included for reference. This experience may then be used to assist in investigating leaks on other aircraft. Note that these details need to be treated with scepticism due to the variability of leaks and the information is presented for guidance only. Should any individual have additional findings or comments on the leaks please inform Concorde Core Office preferably with a diagram.

RB (2) It should also be noted that it is quite possible that a leak rectification that proves successful may eventually fail and the information here will act as guidance in resealing.

B. Tank 9 Wing and Fuselage Tank

(1) Leaks have been found dripping from the drain hole of the machined expansion joint located just forward of Spar 41. Access can be gained by removing belly fairing panel 192/191HB. Fig. 811 details a schematic cross section which illustrates the void location. Fuel leaks dripping from the expansion joint need to be investigated further by removal of upper fillet panels 291/292FT to check which fuel tank the leaks come from. Individual tank leak identification may be required by individually filling each tank. The wing tank 9 may also be isolated by temporarily blocking the transfer pipes between the wing and fuselage cells (Ref. BA drawing 3-44704). Note that tank 10 also needs to be filled as it also has a boundary which can leak into the machined expansion joint.

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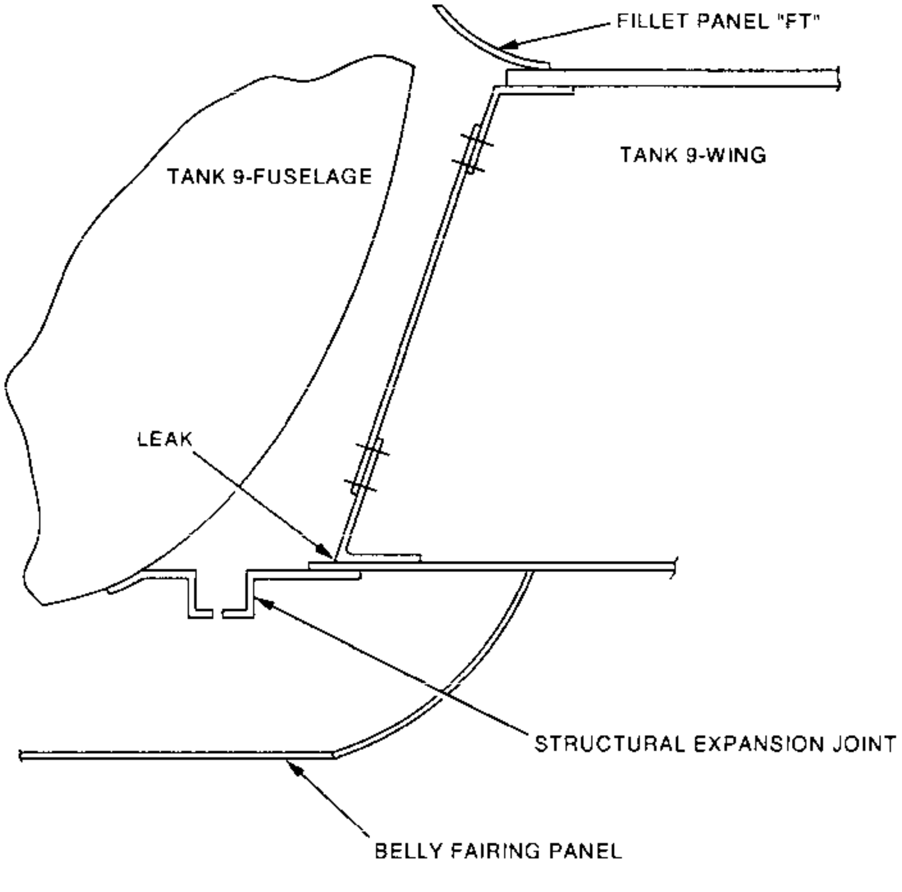

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Schematic Diagram showing the Relationship with Tank 9 Wing and Fuselage Tanks in the Location of the "Void" Area
Figure 811

C. Tank 9 Wing Cell Leaks along Corrugated Web adjacent to the Fuselage

(1) This leak path was rectified on G-BOAE during leak rectification in March 1998. The leak rate had been approximately 170 drops per minute. Fig. 812 details the forward angle section fitting that was resealed. Note sketches show view on left side of aircraft. The figure also shows the complexity of structure at the spar 41 fitting.

D. Tank 9 Fuel Leak Drain - Temporary Fitment

(1) EOI-CON-5369306 details a fuel drain that may be fitted to the machined expansion joint (Ref. Figs. 813 and 814) as a temporary action and with the following restrictions. THIS ACTION MAY ONLY BE AUTHORISED BY EO ACTION AND IS SUBJECT TO THE FOLLOWING CONSTRAINTS.

(a) Carry out a detailed visual inspection at the leak location to ensure that no distress of the structure or fasteners exist.

(b) Carry out a detailed visual inspection of all seals on the main landing gear doors, hydraulic doors and tail gear doors to ensure that they are fitted, have no damage and seal correctly.

NOTE: MEL dispensation is not permitted on these items.

(c) Confirm that there is no damage to electrical cables and connectors in the main landing gear bay.

(d) Visually inspect the drain to ensure that it is draining correctly and there are no internal leaks.

(e) The brake temperature modification to EDI 3269262 must be fitted.

(f) The brake temperature indication system and warning lights, and the brake cooling fans must be operational.

(2) In addition after each flight:

(a) Carry out an inspection of the main landing gear bay for fuel contamination.

(b) Carry out an inspection of the hydraulics bay for fuel contamination. Entry by panel 153 AB/BB.

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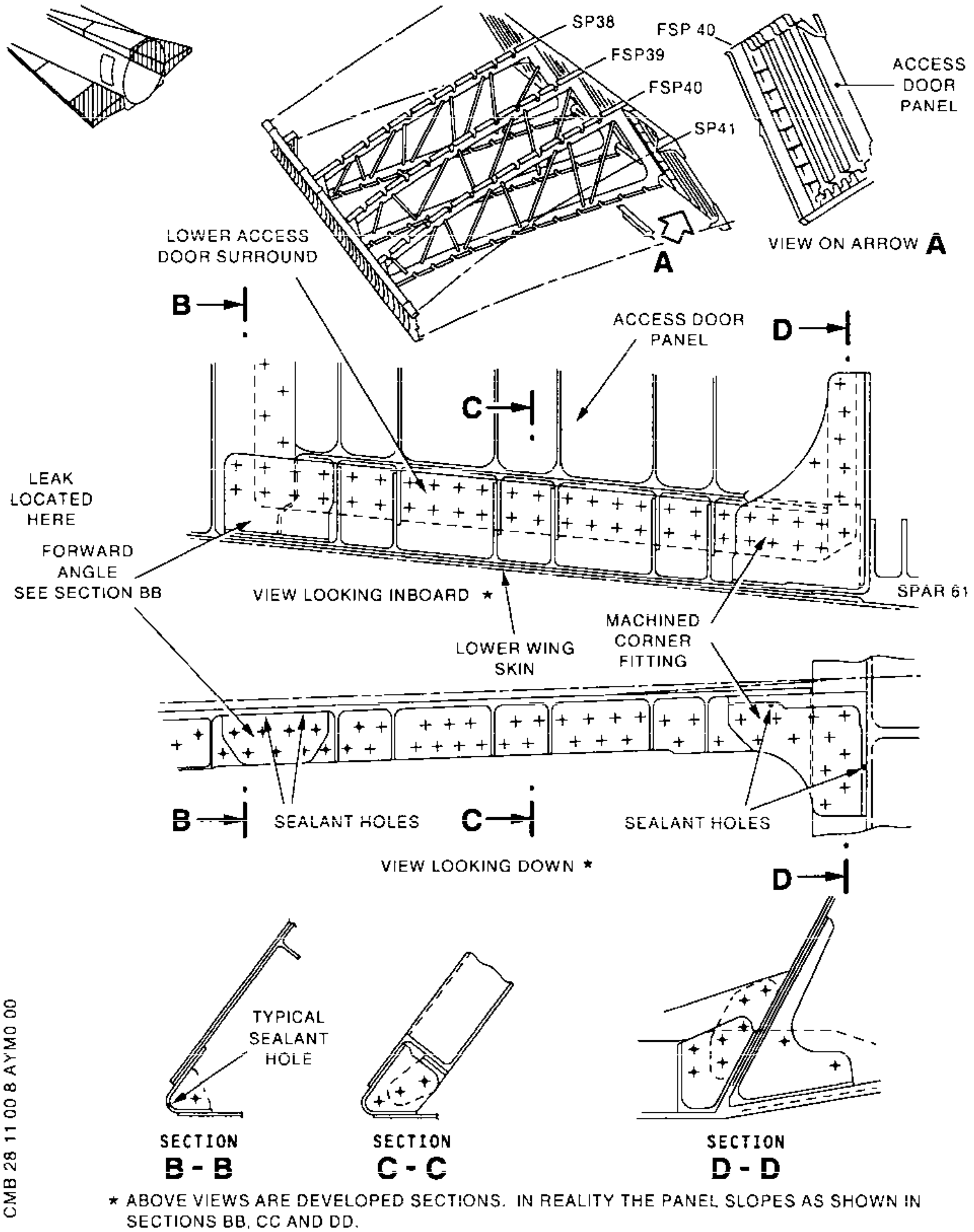

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B Leak Location at Forward Angle Fitting (LH view)
B Figure 812

(c) Carry out an inspection of the inside of the tail cone, access via tail cone bumper door.

<u>WARNING:</u> IN THE EVENT OF CONTAMINATION BEING FOUND ON ANY OF THE ABOVE NO FLIGHT IS PERMITTED.

(3) Make an entry in the aircraft technical log stating that a temporary drain has been fitted at tank 9 machined expansion joint and the following restrictions are applied.

(a) The use of brakes is to be minimized during pre take off taxi.

(b) Limit brake temperature to below 220 degrees C at commencement of take-off roll.

(c) After take-off, delay landing gear retraction until brake temperatures are below 200 degrees C.

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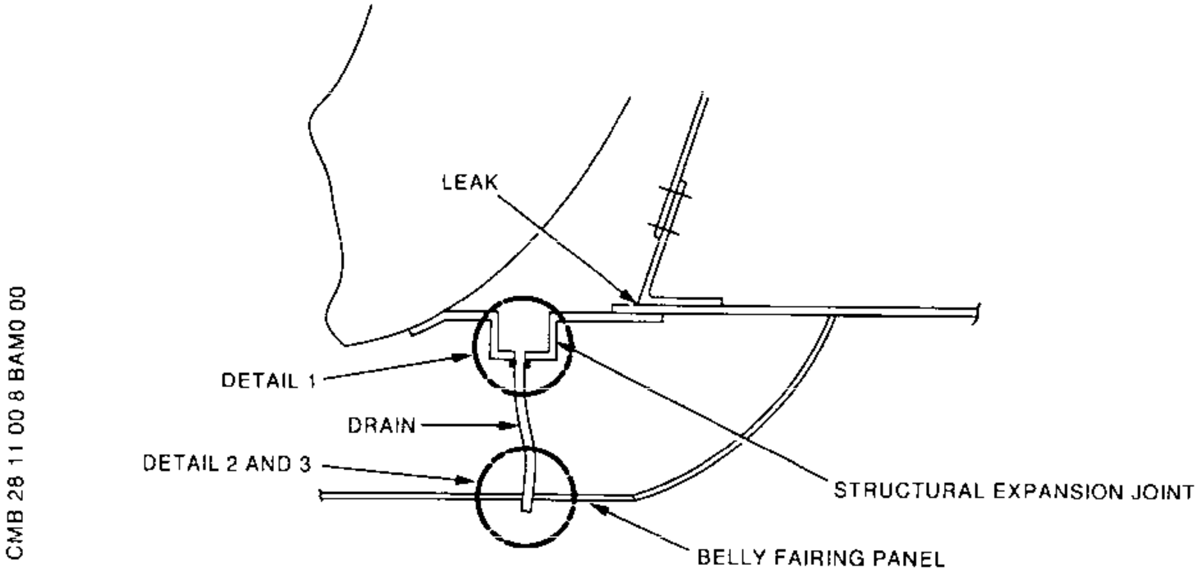
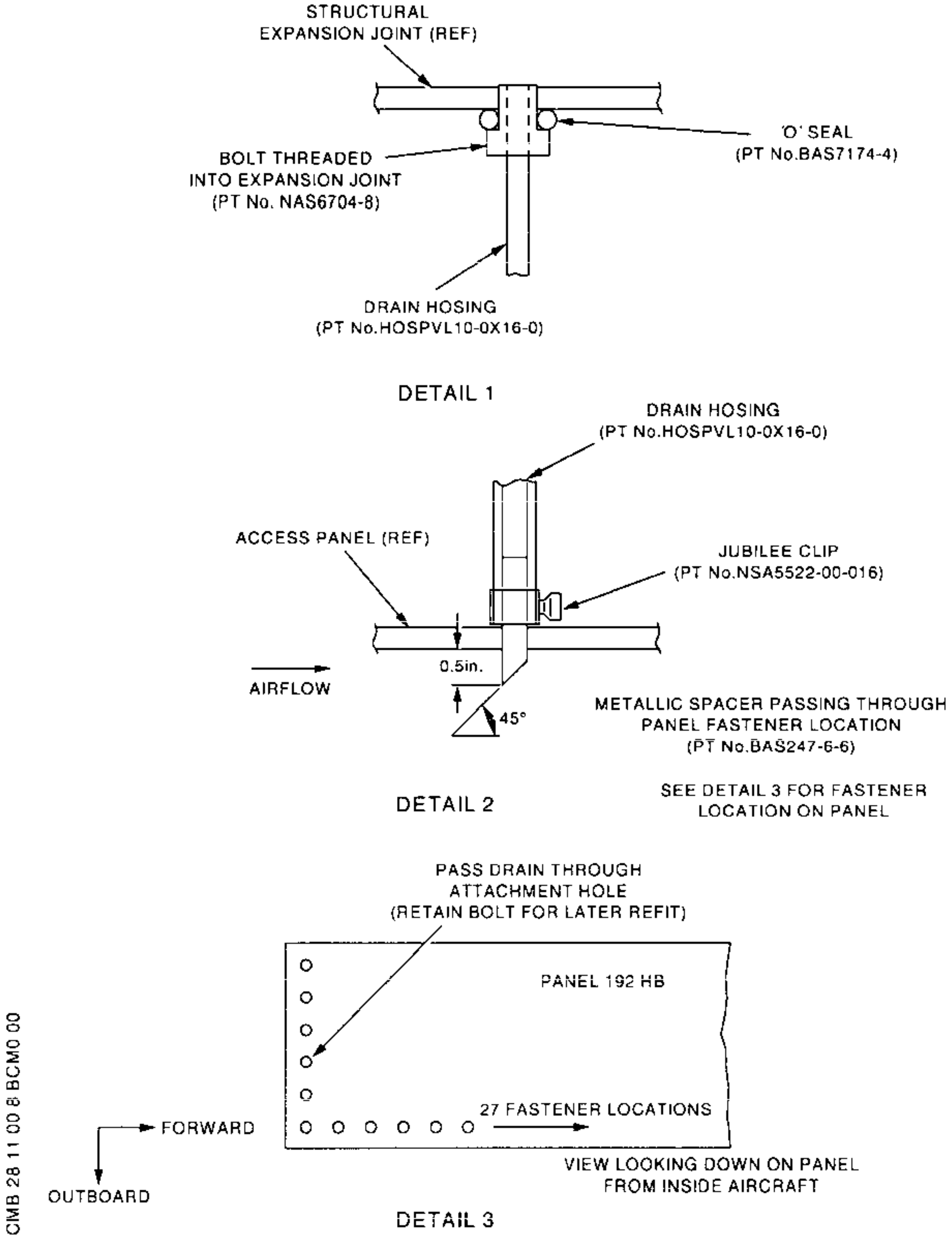


Schematic Diagram showing the Location of the
Fuel Leak Drain
Figure 813



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B Details
B Figure 814

E. Fuel Leaks Found in the Catenary Floor Structure of Tank 9

(1) Leaks were found on G-BOAF in March 1998 in the catenary floor structure. The leak was detected by fuel vapour being smelt in the cabin having leaked via the tank and also through the vapour seal.

The actual source of the leak in the tank was found by pressurizing the fuselage in accordance with 05-59-00. The leaks were also confirmed by using the helium leak detection technique. This involved filling the void between the vapour seal and the tank roof with helium and using the helium detector in the tank. This method also revealed that the vapour seal was leaking at the zip. See 21-25-00 Approved Repairs and RS21-60322 for repair of zips.

Figure 814 shows the location of leaks found in the catenary roof edge structure adjacent to the fuselage skin.

F. Fuel Leaks from Expansion Joints

(1) Cracks in the upper internal expansion joints are a well known feature of the Concorde design and allowable Ref. Service Newsletter CNSL0209-57. BA has a repair scheme to assist in the rectification of leaks at such locations covered by document RS57-42045.

Figure 816 shows a view of a typical expansion joint runout at the spar intersection.

The expansion joint is designed to ensure all loads are transferred from the lower wing skin panel to the spar and not into the fuselage belly skin. The runout is designed to accommodate the spar intersection. The upper expansion joint also retains the fuel whilst the lower has two drain holes in it.

The flexibility of the expansion is lost at the runout and cracks result as shown in the stiff section. Fuel consequently leaks from the tank into the void between joints and then into the fuselage belly panels via the drain holes in the lower expansion joint.

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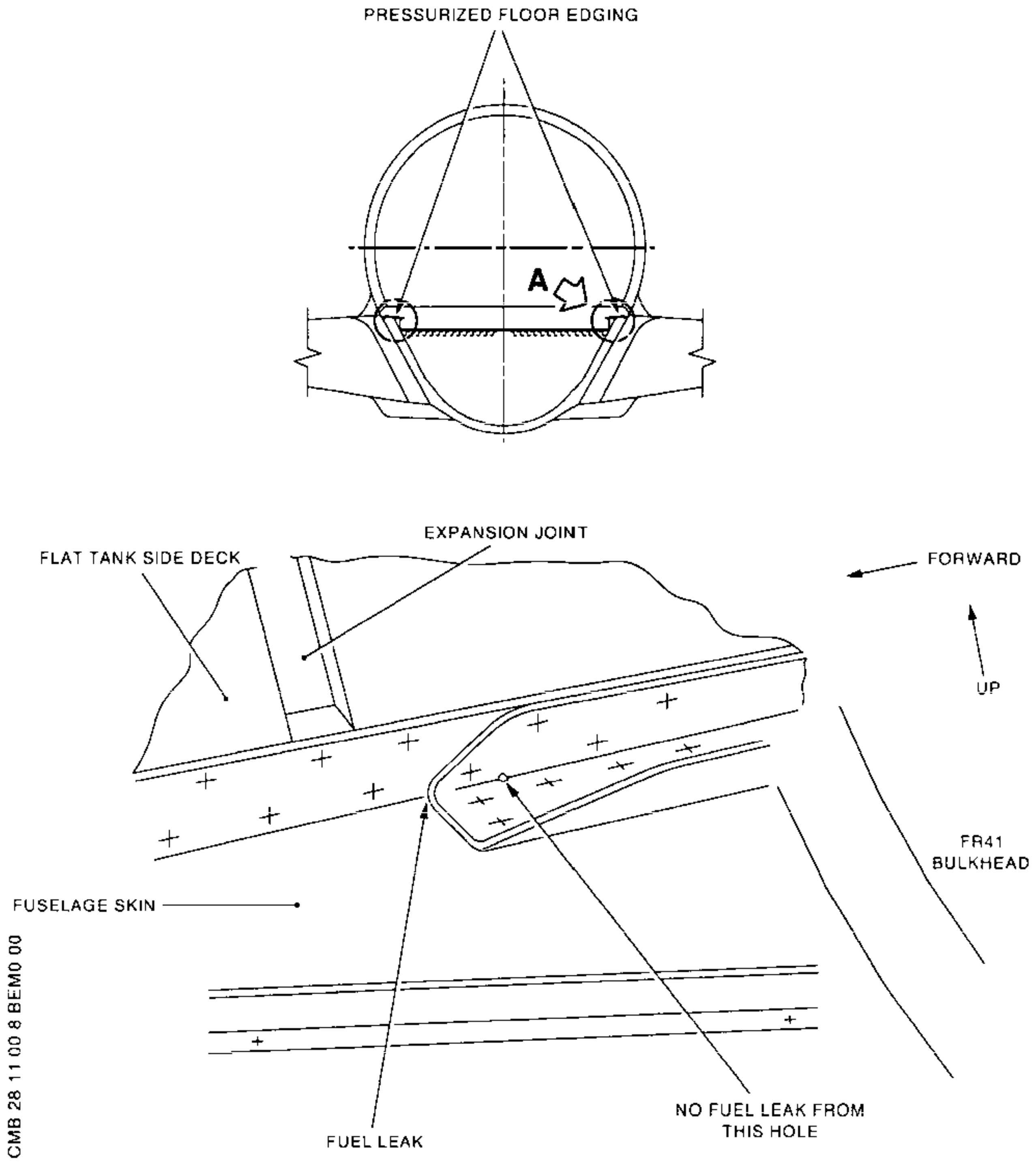

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B Schematic View of Fuel Leak Location in Tank 9
B at FR41 (RH view)
Figure 815

These cracks are stop drilled but will relieve themselves if they enter the parallel section. It is considered uneconomic to replace the expansion joint and they are repaired with two fibreglass plies impregnated with tank sealant.

17. Post Fuel Tank Entry Inspection

A. Following tank entry, the inspections listed below are required:

(1) Carry out a visual inspection to ensure the removal of all equipment used during tank entry.

(2) In all areas, not only the locality of any work, ensure that any residual materials left from work such as sealant debris, cloth remains, swarf, fibres etc. are removed. Wipe the location concerned with a Eurotwill cloth, dampened with fuel to ensure removal of small deposits and dispose in hazardous waste bag (Ref. Engineering Health and Safety Manual S8/P1 and P4).

(3) Carry out a visual inspection of all structure and systems to ensure no defects relating from the work or any other reason exist.

(4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(5) Prior to reattaching the access panel carry out a detailed visual inspection of the panel fuel seal to ensure no defects exist that will result in a leak.

(6) Raise a CAT Q ADD to call for checking the LP fuel filters in accordance with MM 73-14-01, Servicing, para. 2 and 3, within approximately 100 hours (Ref. Omega Job Code 9928005P, Job Type 9).

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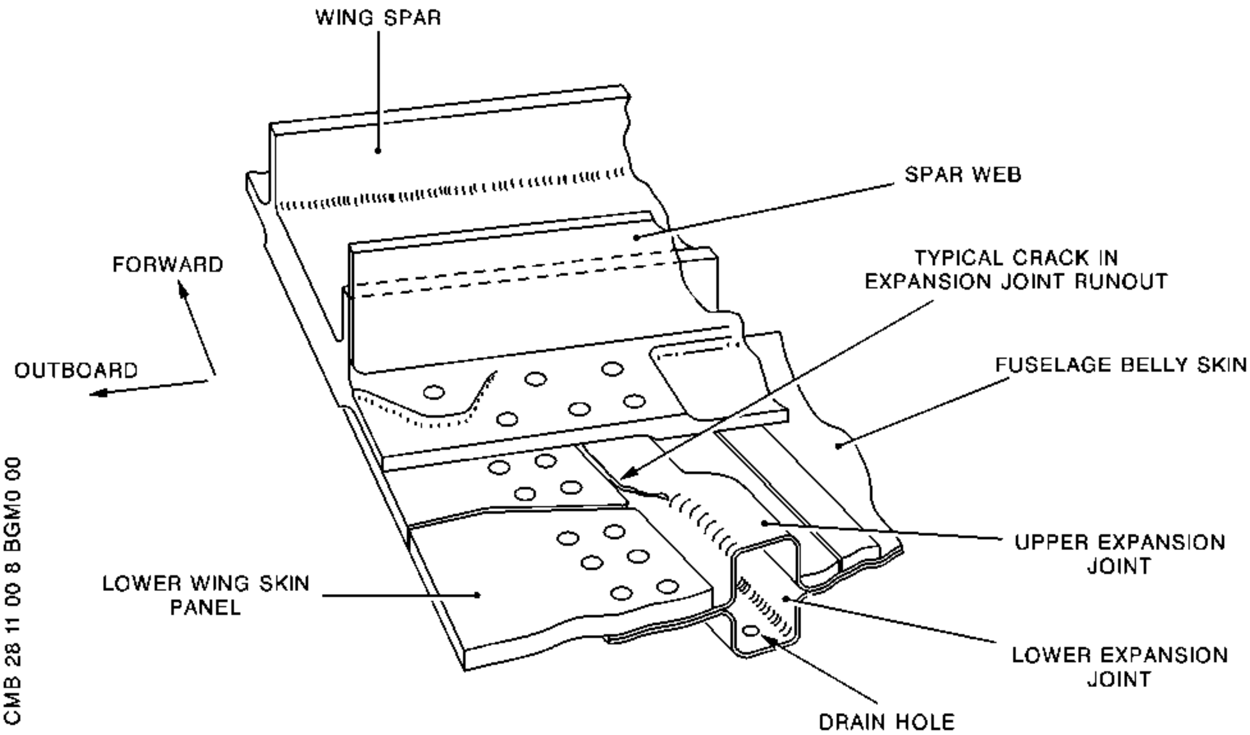

Typical Expansion Joint
Figure 816

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FUEL TANK WATER DRAIN VALVE - REMOVAL/INSTALLATION

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

R There are 28 identical valves located in the lower wing and
R fuselage surfaces. Some are directly accessible; others are accessible through panels in the underwing fairing. Valves fitted beneath the fairing have extension sleeves connecting them to their drain points on the panels.

2. Water Drain Valve - Flush Fitting (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Water drain valve spanner	D925436000
Water drain tool	D925373000
Torque spanner, 150 to 160 lbf in (1.69 to 1.81 mdaN)	-

R B. Prepare

R (1) Drain the appropriate tank (Ref. 28-25-00, Servicing).

C. Remove

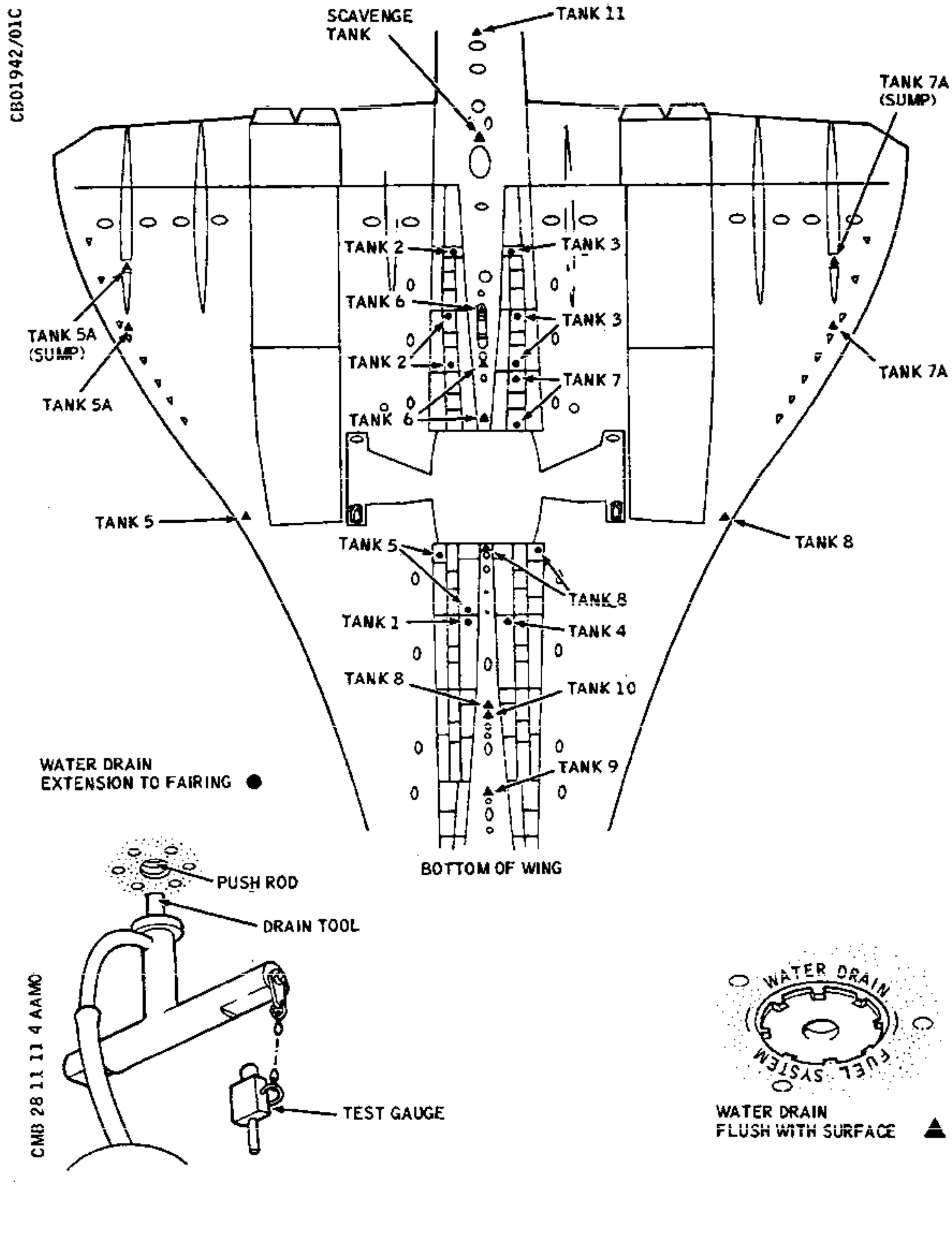
R (1) Disengage the lockring from the valve flange.

R (2) Using the water drain valve spanner, remove the
R valve from the mounting; remove and discard the
R lockring.

(3) Remove and discard the O-ring seal.

D. Install

(1) Check that the mating surfaces of the valve, flange and the valve recess in the skin are clean and
R undamaged. Lubricate a new O-ring seal in accordance
R with 20-23-11, then fit the seal and new lockring
R to the valve.



R Water Drain Valves - Location
Figure 401

(2) Screw the valve into its mounting and tighten it with the water drain valve spanner; torque-tighten the valve to between 150 and 160 lbf in (1.69 and 1.81 mdaN).

(3) Lock the valve in position by pressing the lockring into one of the slots on the valve flange.

(4) Refuel the tank (Ref. 12-11-28).

(5) Test the valve as follows:

(a) Using the water drain tool, check that the valve operates smoothly.

(b) Check that there is no leakage of fuel from between the valve flange and the tank floor.

(c) Insert the short end of the test gauge to depress the spring-loaded inner valve the correct amount. Hold the valve in this position for 5 min. Over this period there must be no leakage of fuel from the valve. Remove the gauge.

(d) Insert the long end of the gauge through the hole in the inner valve.

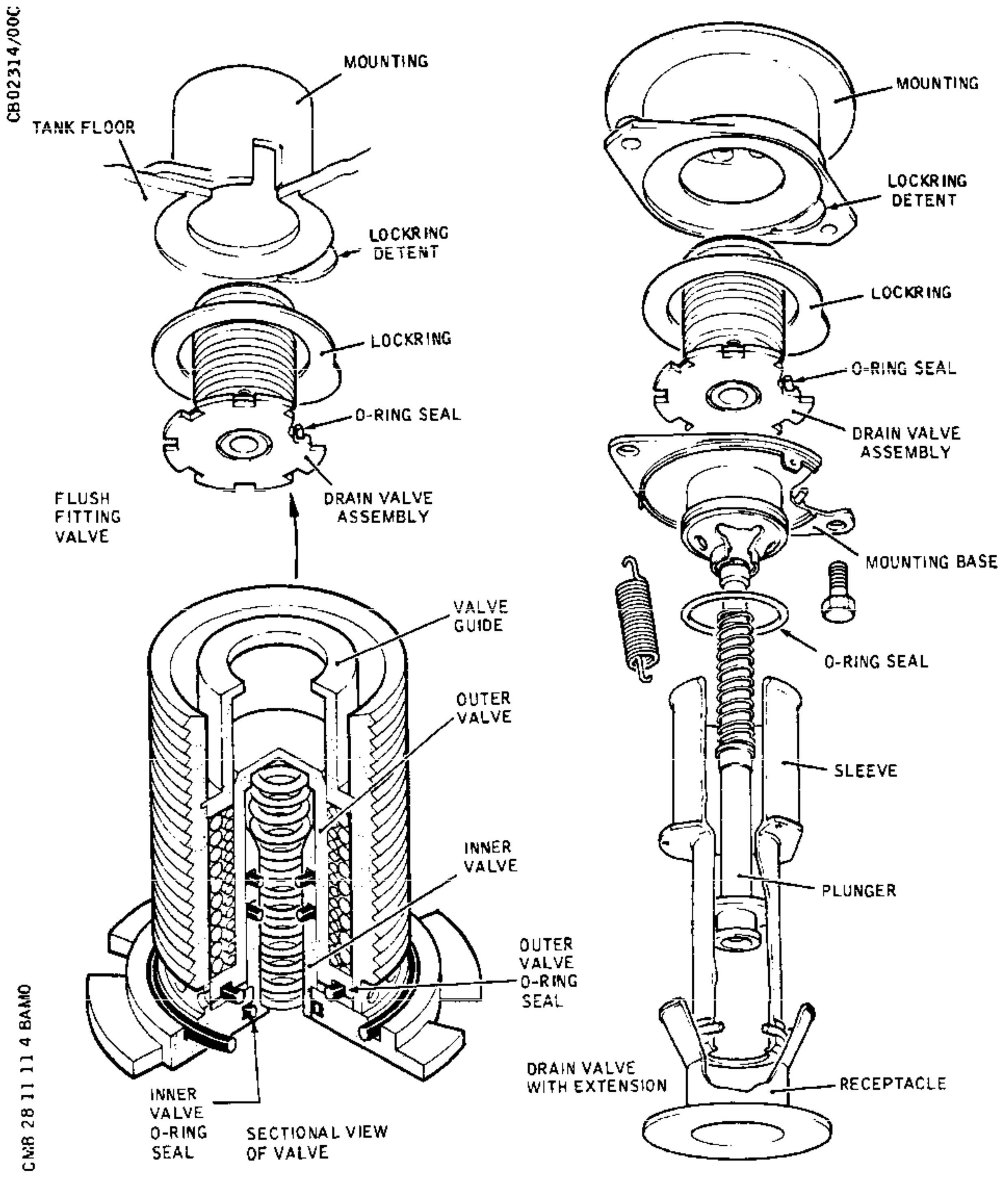
(e) Using the gauge, depress the spring-loaded outer valve and hold it depressed for 5 min. Over this period there must be no leakage of fuel from the valve. Remove the gauge.

3. Water Drain Valve with Extension (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Water drain valve spanner	D925436000
Water drain tool	D925373000
Torque spanner, 150 to 160 lbf in (1.69 to 1.81 mdaN)	-

B. Prepare



Water Drain Valves - Installation
Figure 402

R

(1) Drain the appropriate tank (Ref. 28-25-00, Servicing).

(2) Remove the appropriate access panel (Ref. Fig. 401).

C. Remove

(1) Remove the springs securing the sleeve to the mounting base; remove the sleeve.

(2) Remove and discard the O-ring seal from the sleeve.

(3) Remove the nuts, washers and bolts securing the mounting base to the mounting; remove the base.

(4) Remove and discard the O-ring seals from the mounting base.

(5) Disengage the lockring from the valve flange.

(6) Using the water drain valve spanner, remove the valve from the mounting; remove and discard the lockring.

(7) Remove and discard the O-ring seal from the valve.

D. Install

NOTE: New O-ring seals must be lubricated in accordance with 20-23-11.

(1) Check that the mating surfaces of the valve flange and the mounting are clean and undamaged, then fit a new O-ring seal and a new lockring to the valve.

(2) Screw the valve into its mounting and tighten it with the water drain valve spanner; torque-tighten the valve to between 150 and 160 lbf in (1.69 and 1.81 mdaN).

(3) Lock the valve in position by pressing the lockring into one of the slots on the valve flange.

(4) Test the valve (Ref. para.2.D.).

(5) Check that the mating surfaces of the valve and the mounting base are clean and undamaged, then fit a new O-ring seal to the mounting base.

(6) Secure the mounting base to the valve mounting with bolts washers and nuts. Torque-tighten each

R nut to between 60 and 70 lbf in (0.675 and 0.79 mdaN).

(7) Check that the mating surfaces of the mounting base and sleeve are clean and undamaged, then fit a new O-ring seal to the mounting base.

R (8) Position the sleeve on the mounting base and secure it
R with the springs.

(9) Check that the mating surfaces of the sleeve and the receptacle are clean and undamaged, then fit a new O-ring seal to the sleeve.

R E. Conclusion

R (1) Refit the appropriate access panel.

R 4. Inner Valve Seal Renewal - In Situ

R A. Renew

R (1) Using a suitable tool, depress the inner valve clear
R of its O-ring seal.

R (2) Remove and discard the O-ring seal from the inner
R valve housing.

R (3) Lubricate a new O-ring seal in accordance with
R 20-23-11, then fit the seal to the valve.

(4) Remove the tool.

R (5) Test the valve (Ref. para.2.D.).

MAGNETIC LEVEL INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE PRECAUTIONS FOR ENTERING FUEL TANKS DETAILED IN 28-10-00.

1. General

One magnetic level indicator (MLI) unit is installed in each of tanks 5, 6, 7, 8, 10 and 11. Two units are installed in each of the left and right cells of tank 9. Although the overall length of the indicator units varies according to the particular tank installation, their construction and installation, with the exception of the unit installed in tank 11, is identical.

In tank 11 the MLI is supported midway along its outer tube by a clip fitted to a rib of the tank at frame 84. The MLI has two floats, one operating above the support clip and the other below it. The top of the MLI fits into a mounting plate on the interior of the tank roof.

Each float is electrically bonded to its MLI by a bonding wire. To ensure good electrical contact between the float and the bonding wire, the wire is an S-shaped spiral, to give either a 140 deg or 180 deg rotary movement (Ref. Fig. 401) (Sheet 2) to the float during its travel. A straight section at the top of the 'S' and a similar section at the bottom permit the float to make full contact with the rubber of the wire support clip at the bottom and the rubber sleeve at the top.

After Mod.1984: A bonding wire support plate is added under the top attachment of the bonding wire crimped tag, for the installations in tanks 5, 6, 7, 8, 9 and 10.

The base adapters for all MLI installations are similar in assembly and installation. If required, the adapter may be removed and details are given in this topic.

Access to the MLIs is gained after draining the tank and removing the appropriate tank access panel.

A procedure is also given for the removal and installation of the MLI inner assembly. It is not necessary to drain and enter the tank for this operation.

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2. Magnetic Level Indicator - Tanks 5, 6, 7, 8, 9 and 10
(Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
C-spanner adapter, double-sided, for upper and lower ringnuts	T6501E222374
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner with (Torq-set) adapter, 70 to 80 lbf in (0.791 to 0.904 mdaN)	
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Cleaner, for MLI metal components: Trichloroethane (Ref. 20-30-00, No.485)	-

B. Prepare to Remove MLI - Tank 5, 6, 7, 8, 9 or 10

(1) Defuel the appropriate tank (Ref. 28-25-00, Servicing).

(2) Ensure that all switches and controls on the fuel management and refuel control panels are at their normal ground setting. Place warning placards at panel locations to indicate that the switches are to remain as set.

(3) Remove the appropriate access panel (Ref. Fig. 401) and prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove MLI - Tank 5, 6, 7, 8, 9 or 10

CAUTION: TO AVOID KINKING OR DISTORTION, DO NOT HANDLE THE MLI BY ITS BONDING WIRE.

(1) Unlock and, using the C-spanner, fully unscrew the upper ringnut at the base of the MLI in the tank.

Before Mod.1984

(2) Remove the two bolts which secure the support plate, washer and bonding wire of the MLI to the bracket on the tank roof.

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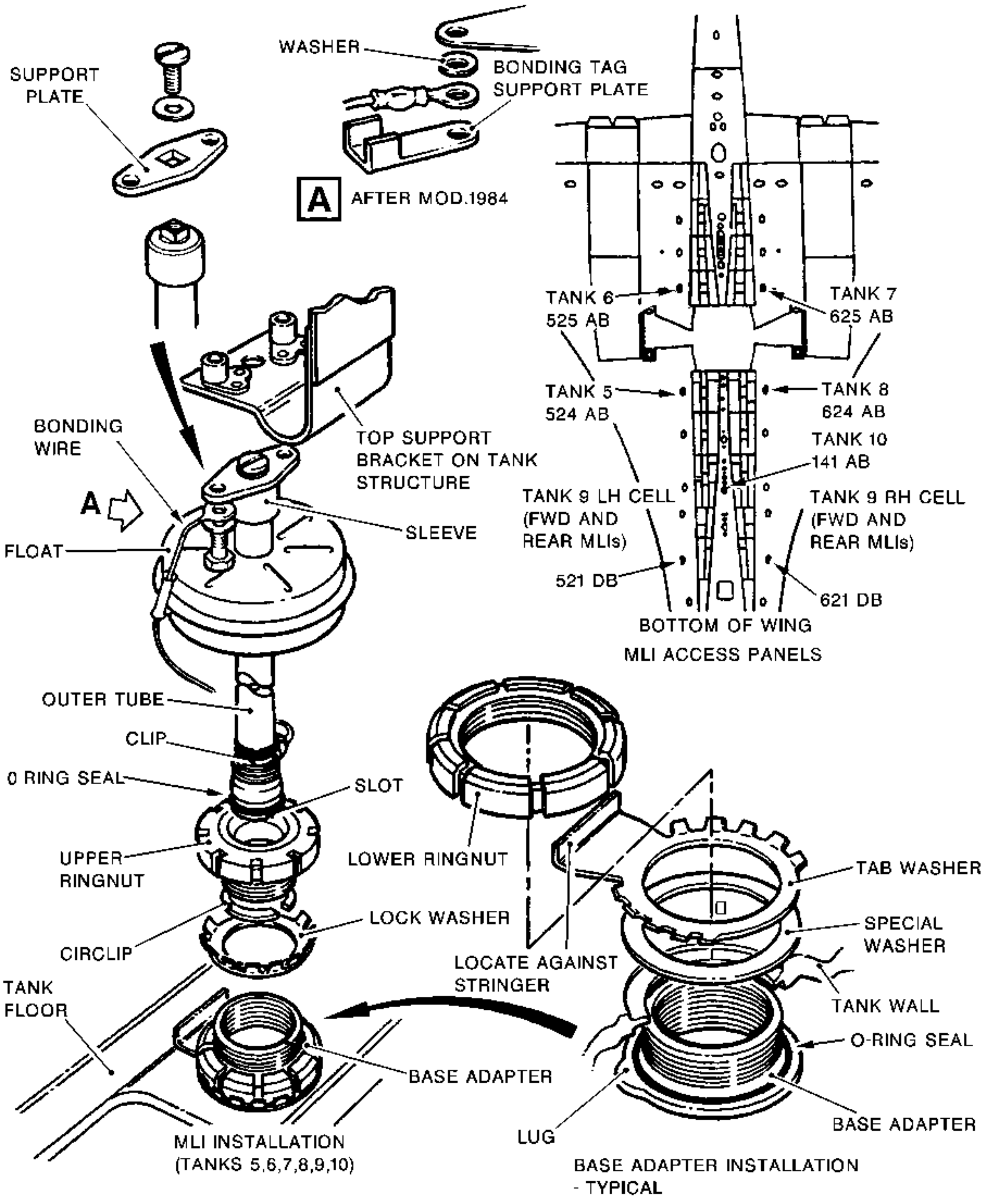
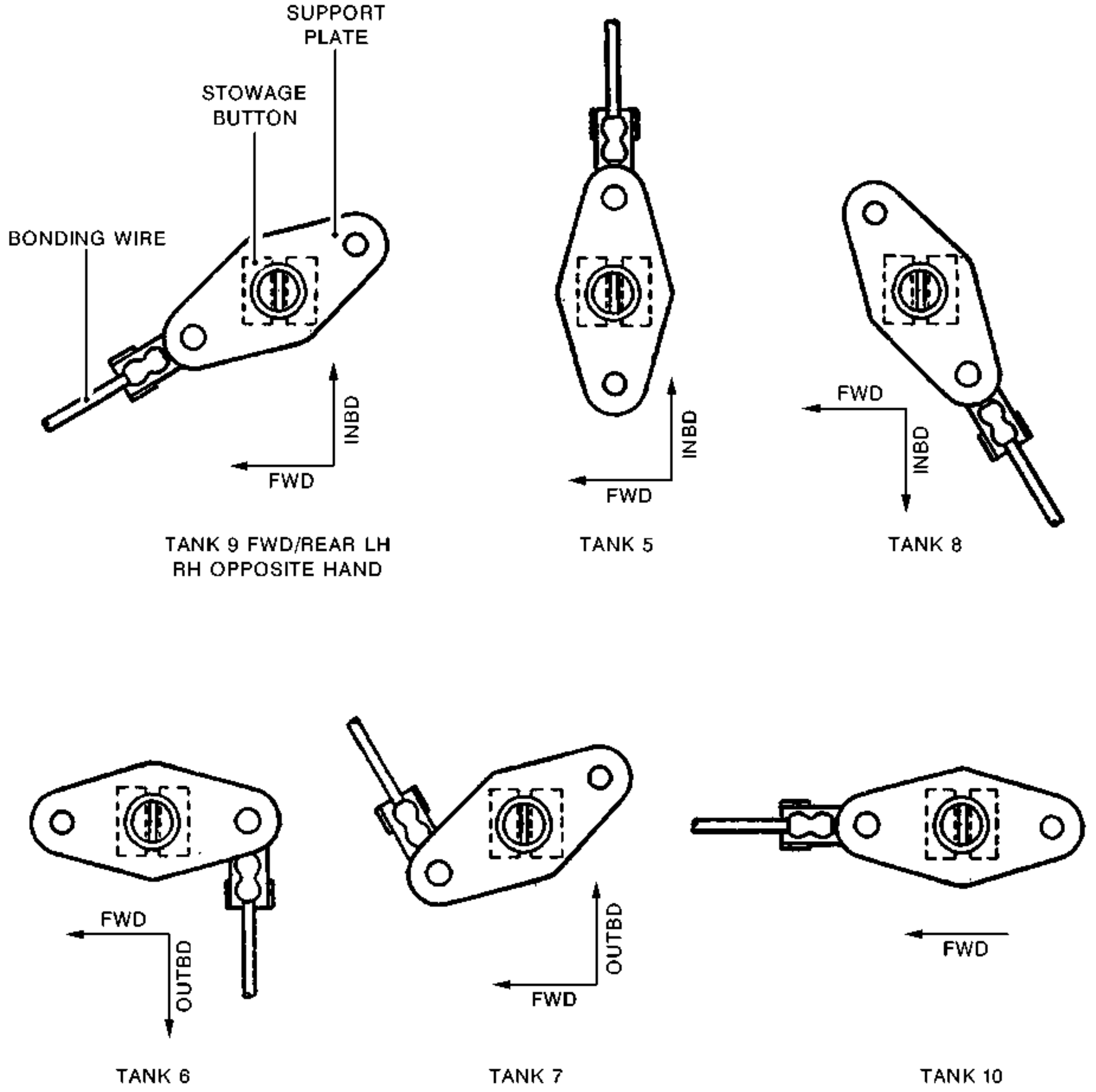


Magnetic Level Indicator - Installation
Figure 401 (Sheet 1 of 2)



NOTE: PLAN VIEWS SHOWING THE RELATIONSHIP OF STOWAGE BUTTON/BONDING WIRE TO THE TOP SUPPORT PLATE. THE STRUCTURE BRACKET IS OMITTED FOR CLARITY.

THE SPIRAL OF THE MLI BONDING WIRE IN TANKS 5,8, 9 REAR LH/RH AND 10, IS SET TO APPROXIMATELY 180 deg. FOR TANKS 6,7 AND 9 FWD LH/RH, THE SPIRAL IS SET TO APPROXIMATELY 140 deg.

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Magnetic Level Indicator - Installation
Figure 401 (Sheet 2 of 2)

After Mod.1984

(2) Remove the two bolts which secure the support plate, washer, bonding wire and bonding wire support plate to the bracket on the tank roof.

(3) Displace the MLI support plate from the bracket and then lift the MLI clear of the base adapter on the tank floor and remove it from the tank through the main access panel.

(4) Remove and discard the O-ring seal.

(5) Remove the circlip and ringnut from the base of the MLI. Retain the circlip. Discard the lockwasher and screw the ringnut temporarily into the base adapter in the tank.

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D. Install MLI - Tank 5, 6, 7, 8, 9 or 10

CAUTION: TO AVOID KINKING OR DISTORTION, DO NOT HANDLE THE MLI BY ITS BONDING WIRE.

NOTE: A new MLI for these tanks has a 'transit only' nut and bolt that retains the bonding wire and bonding wire support plate at the top support plate. The nut and bolt must be removed and returned with the defective MLI.

When the MLI is installed, with the calibrated tube in the up-and-locked position, the slot in the stowage button must be parallel to the lateral axis of the aircraft. This will be achieved provided that the top support plate is correctly orientated (Ref. Fig.401) (Sheet 2).

(1) Observe the fuel and electrical safety precautions.

(2) If necessary, clean the metal components of the MLI with trichloroethane.

(3) Remove the upper ringnut from the base adapter in the tank, position the ringnut on the MLI and refit the circlip.

(4) Position a new lockwasher on the base adapter and fit a new O-ring seal, lubricated in accordance with 20-23-11, to the base of the MLI. Insert the base of the MLI into the adapter. Ensure that the circlip is fully seated around the base of the MLI and then screw in the upper ringnut, finger-tight.

(5) Locate the support plate of the MLI on the support bracket at the top of the tank. Position the washer, bonding wire and bonding wire support plate under the support plate, and secure the plate to the bracket with two bolts and washers. Torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

NOTE: After Mod.1984: The bolt that secures the bonding wire assembly is slightly longer than the other bolt.

(6) Torque-tighten the upper ringnut at the base of the MLI to between 35 and 44 lbf in (0.395 and 0.497 mdaN) and bend the tab of the lockwasher into a recess of the ringnut to lock the ringnut.

(7) Check that the electrical bonding is in accordance with 20-27-11.

(8) Release the stowage button and withdraw the calibrated tube until the inner and outer magnets link. Operate the calibrated tube slowly over its full extent and check that the float rotates, 180 deg or 140 deg, as appropriate, along the outer tube to make contact with the sleeve, and then the rubber-lined clip, without obstruction or distortion of the bonding wire.

E. Conclusion

(1) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(2) Ensure that the mating faces of the tank access panel and structure are clean and that the seal is not damaged. Refit the access panel and torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(3) Check that the electrical resistance between the panel and adjacent structure does not exceed 10 milliohm (Ref. 20-27-11).

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R (4) Carry out a Functional Test of the MLI (Ref. Adjustment/Test).

R (5) After refuelling, check the tank access panel for freedom from leakage.

3. Magnetic Level Indicator - Tank 11 (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
C-spanner adapter, double-sided, for upper and lower ringnuts	T6501E222374
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner with (Torq-set) adapter, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Petroleum jelly (Ref. 20-30-00, No.27)	-
Cleaner, for MLI metal components:	
Trichloroethane (Ref. 20-30-00, No.485)	-

B. Prepare to Remove MLI - Tank 11

(1) Defuel the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all switches and controls on the fuel management and refuel control panels are at their normal ground settings. Place warning placards at the panel locations to indicate that the switches are to remain as set.

(3) Remove the appropriate access panel (Ref. Fig.402) and prepare the tank for entry (Ref. 28-10-00, Servicing).

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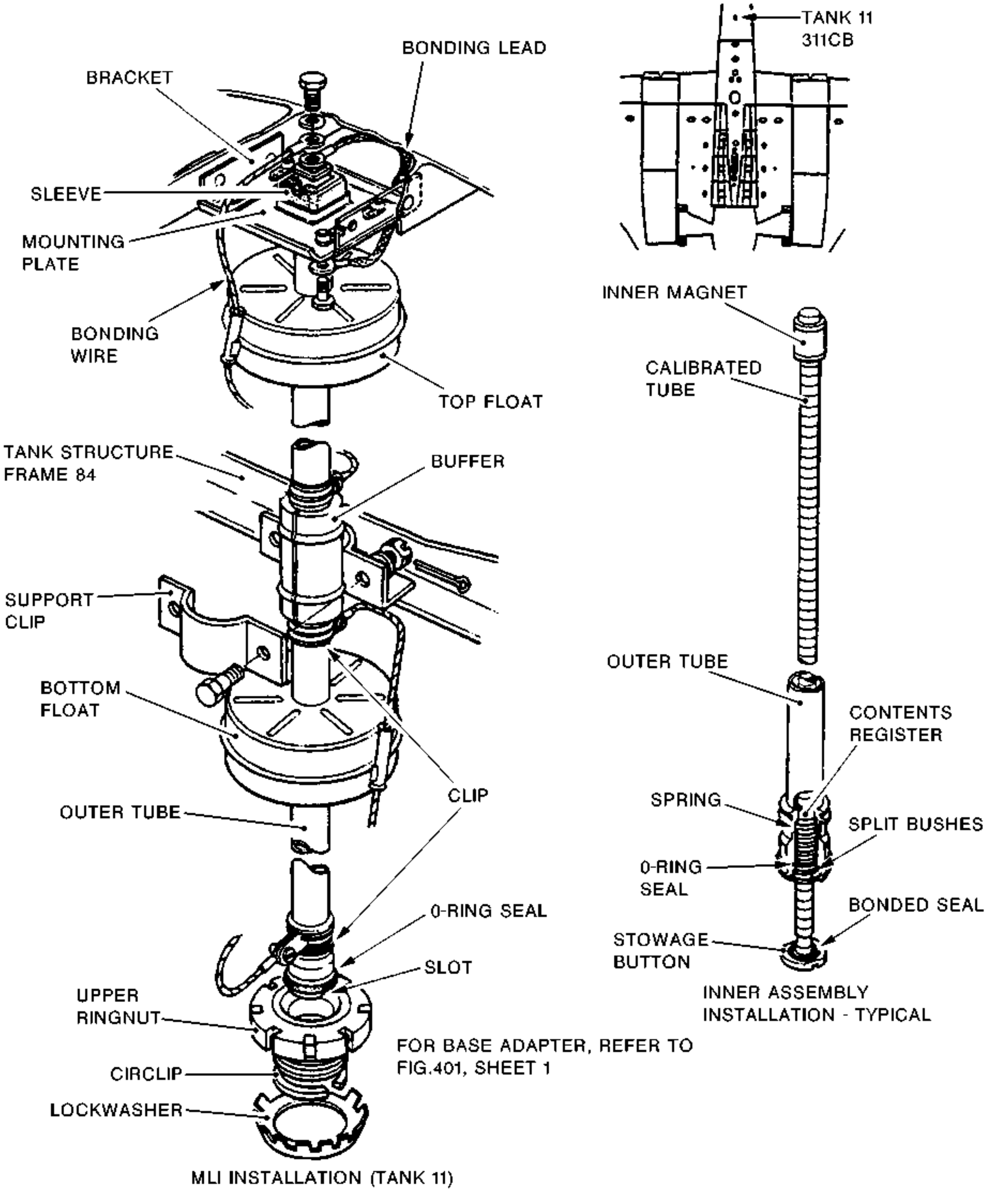

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Magnetic Level Indicator - Installation
Figure 402

C. Remove MLI - Tank 11

(1) Remove and retain the four bolts securing the top mounting plate and bonding lead to the bracket on the tank roof structure.

(2) Unlock and, using the C-spanner, fully unscrew the upper ringnut at the base of the MLI in the tank.

(3) Remove the support clip midway up the MLI at frame 84.

(4) Lift the MLI clear of the base adapter on the tank floor and then remove the base adapter (Ref. para.4.C.).

(5) Remove and discard the O-ring seal.

(6) Remove and retain the circlip at the base of the MLI. Remove the ringnut. Remove and discard the lockwasher.

(7) Remove the MLI from the tank as follows:

(a) Lower the MLI approximately 1.5 ft (457 mm) through the base adapter hole in the tank floor, ensuring that the bonding wires and floats are protected from damage.

(b) Incline the MLI so that it is clear of the tank structure and components.

(c) Withdraw the MLI into the tank and lower it through the access panel aperture.

(8) Remove from the top end fitting the screw and washer securing the bonding wire and lead.

(9) Remove the top mounting plate from the MLI. Refit, with the screw and washer, the bonding wire and lead to the top end fitting.

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D. Install MLI - Tank 11

CAUTION: TO AVOID KINKING OR DISTORTION, DO NOT HANDLE THE MLI BY ITS BONDING WIRE.

NOTE: When the MLI is installed, with the calibrated tube in the up-and-locked position, the slot in the stowage button must be parallel to the lateral axis of the aircraft. This will be achieved provided that the top sleeve is correctly orientated in the mounting plate.

(1) Observe the fuel and electrical safety precautions.

(2) If necessary, clean the metal components of the MLI with trichlorethane.

(3) Remove from the top end fitting the screw and washer securing the bonding wire and lead. Fit the top mounting plate over the top end fitting and refit, with the screw and washer, the bonding wire and lead. Ensure that the bonding wire is correctly orientated.

NOTE: The top mounting plate is positively located relative to the structure by unequally spaced bolt holes.

(4) Position the upper ringnut on the MLI and refit the circlip.

(5) Position the MLI inside the tank and loosely assemble, with the four bolts, the top mounting plate and bonding lead to the structure bracket.

(6) Install the base adapter (Ref. para.4.D.).

(7) Position a new lockwasher on the base adapter and fit a new O-ring seal, lubricated in accordance with 20-23-11, to the base of the MLI. Insert the base of the MLI into the base adapter on the tank floor.

(8) Ensure that the circlip is fully seated and then screw in the upper ringnut. Torque-tighten the ringnut to between 35 and 44 lbf in (0.395 and 0.497 mdaN) and bend the tab of the lockwasher into a recess of the ringnut to lock the ringnut.

(9) Secure, with the four bolts, the top mounting plate and bonding lead to the structure bracket. Torque-tighten each bolt to between 35 and 44 lbf in (0.395 and 0.497).

(10) Check that the electrical bonding is in accordance with 20-27-11.

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(11) Secure the MLI to the tank rib at frame 84 with the support clip, two bolts, nuts and washers. Torque-tighten each bolt to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock the nut with a split pin.

(12) Release the stowage button and withdraw the calibrated tube until the inner magnet links with the outer magnet of the lower float. Operate the calibrated tube slowly over its full extent and check that each float rotates 180 deg along the outer tube to make contact with the rubber-lined clips and sleeve, without obstruction or distortion of the bonding wire.

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E. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) Ensure that the mating faces of the tank access panel and structure are clean.

R (3) Fit a new door seal, lubricated with petroleum jelly.

R (4) Refit the panel as follows:

(a) Simultaneously, insert the door bolts from the LH and RH sides of the door and progressively work toward the centre. Hand-tighten the bolts in the same procedure.

(b) Alternatively, working from the LH and RH sides of the door and progressively toward the centre, torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(c) Repeat the above operation (b), but torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

R (5) Check that the electrical resistance between the panel and adjacent structure does not exceed 10 milliohm (Ref. 20-27-11).

R (6) Carry out a Functional Test of the MLI (Ref. Adjustment/Test).

R (7) After refuelling, check the tank access panel for freedom from leakage.

4. Base Adapter (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
C-spanner adapter, double-sided, for upper and lower ringnuts	T6501E222374
Torque-spanner, 175 to 220 lbf in (1.989 to 2.486 mdaN)	-

B. Prepare to Remove Base Adapter

(1) Remove the MLI (Ref. paras.2. and 3.).

C. Remove Base Adapter

(1) From inside the tank, open the tabwasher and, using the C-spanner, remove the lower ringnut, tabwasher and special washer and, from outside the tank, withdraw the adapter.

(2) Check for damaged surfaces. Discard the tabwasher. Remove and discard the O-ring seal.

D. Install Base Adapter

(1) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the base adapter.

(2) Insert the adapter from outside the tank, ensuring that the lug fits in the recess in the fuselage skin.

(3) From inside the tank, fit the special washer, a new tabwasher and the lower ringnut, positioning the lug on the tabwasher against the stringer.

(4) Torque-tighten the ringnut to between 175 and 220 lbf in (1.989 and 2.486 mdaN). Bend the tab to lock the nut.

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E. Conclusion

(1) Install the MLI (Ref. para.2. or 3.).

(2) Refit the tank access panel (Ref. para.2. or 3.).

(3) Carry out a Functional Test of the MLI (Ref. Adjustment/Test).

5. Inner Assembly (Ref. Fig.401)

A. Remove Inner Assembly

(1) Depress and rotate the stowage button and pull the calibrated tube downward.

(2) Push upward on the contents register and then, using a screwdriver, extract the split bushes.

(3) Withdraw the inner assembly complete with the spring and contents register. Retain the spring. Remove the O-ring seal from the contents register. Discard the seal.

B. Install Inner Assembly

(1) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the contents register. Ensure that the seal bonded behind the stowage button is secure and undamaged.

(2) Fit the original spring over the magnet at the end of the inner assembly and position the spring on the contents register.

(3) Insert the inner assembly into the outer tube. Press upward on the contents register against the spring and insert the split bushes. Allow the spring pressure to return the register and trap the split bushes.

C. Conclusion

(1) Carry out a Functional Test of the MLI (Ref. Adjustment/Test).

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MAGNETIC LEVEL INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

OBSERVE THE DEFUELLING LIMITATIONS DETAILED IN 28-25-00, SERVICING.

1. General

One magnetic level indicator (MLI) is installed in each of tanks 5, 6, 7, 8 10 and 11; two indicators are installed in each of the left and right cells of tank 9. Each MLI is calibrated according to its tank position prior to installation. This topic comprises a Functional Test of a MLI. Operational and System Tests are not required in this application.

2. Functional Test

A. Prepare to Test

(1) Defuel the appropriate tank (Ref. 28-25-00).

B. Test

(1) Turn the slotted end of the stowage latch of the MLI on the underside of the tank until the slot is parallel to the centre-line of the aircraft. Allow the calibrated tube to drop to its extended position and check that a zero reading is indicated.

(2) Slowly lift the calibrated tube, check that it moves freely and that when fully raised the float is distinctly heard to drop on the buffer at the base of the MLI as magnetic contact is broken with the top of the tube.

(3) Lift the calibrated tube and depress the stowage latch into the locking cover. Turn the latch until the latch slot is coinciding with the two lines engraved on the cover.

(4) Refuel the tank (Ref. 12-11-28).

(5) Turn the slotted end of the stowage latch to allow the calibrated tube to extend. Check that the tube extension is appropriate for the tank fuelled condition (Ref. 28-11-00).

(6) Retract the calibrated tube and turn the stowage latch until the slot coincides with the markings on the

cover.

(7) Check that there is no fuel leakage through the base of the MLI over a minimum period of 10 min.

R

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AIRCRAFT ATTITUDE INDICATOR - REMOVAL INSTALLATION

1. General (Ref. Fig. 401)

An aircraft attitude indicator is fitted near the refuel control panel in the underwing fairing. It is bolted to a mounting bracket which is fitted to the structure.

Access to the indicator is gained by opening the refuel control panel access door.

2. Aircraft Attitude Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 23 to 27 lbf in (0.26 to 0.305 mdaN)	-

B. Prepare

(1) Open the refuel control panel access door 194 JB.

(2) Remove the three quick-release pins which secure the rear face of the refuel control panel and lower the panel in order to facilitate removal of the indicator.

C. Remove

(1) Note the position of the special bonding bolt (Ref. Fig. 401).

(2) Remove the three bolts, washers and locknuts securing the indicator to the mounting bracket.

D. Install

(1) Ensure that the mating surfaces of the indicator attachment lugs and the mounting bracket are clean and undamaged.

(2) With the special bonding bolt correctly positioned, secure the indicator to the mounting bracket with the bolts, washers and locknuts. Torque-tighten each bolt to between 23 and 27 lbf in (0.26 and 0.305 mdaN).

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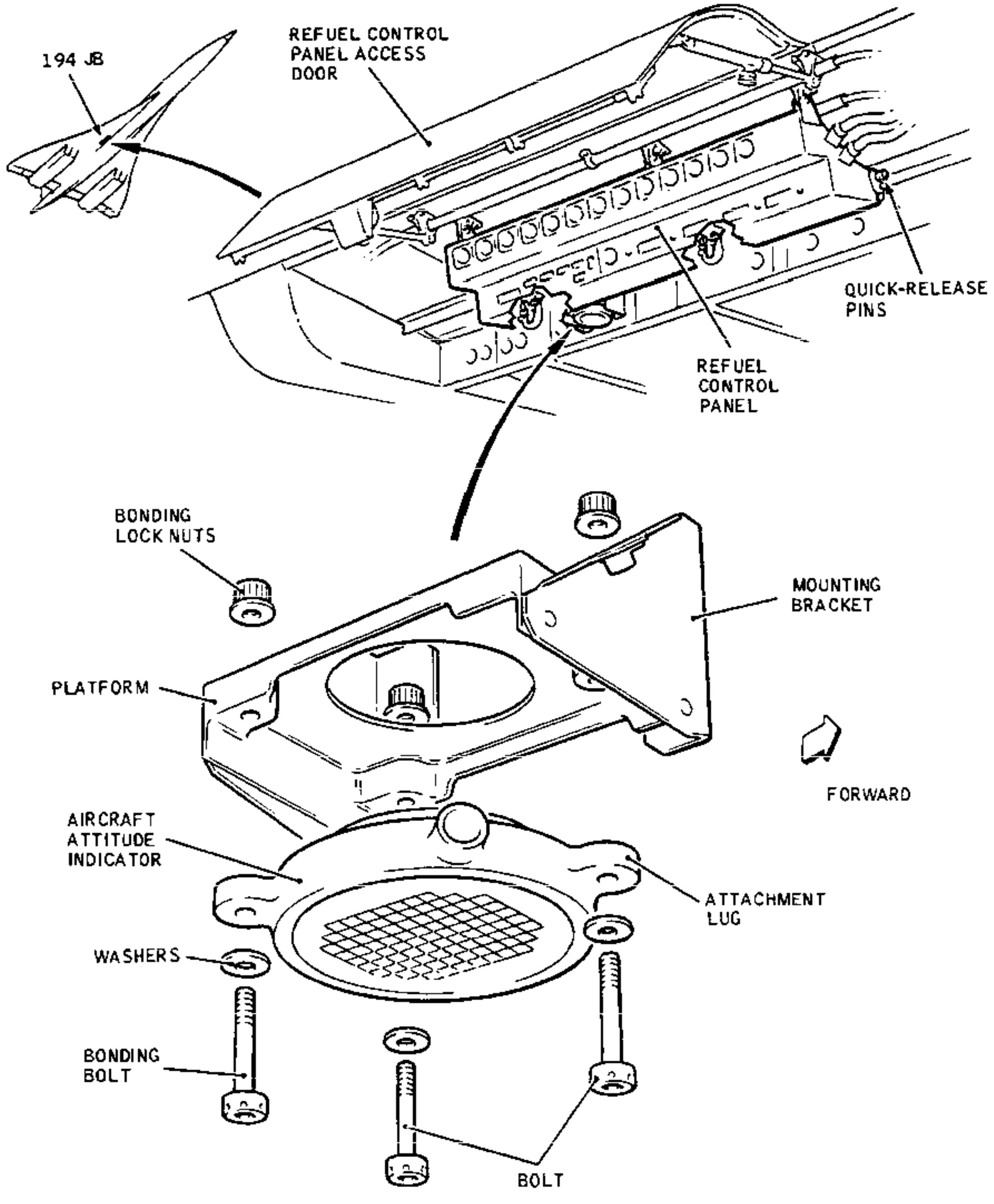

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- Aircraft Attitude Indicator - Installation
Figure 401

E. Conclusion

(1) Secure the rear face of the refuel control panel with the quick-release pins.

(2) Carry out a Functional Test of the indicator (Ref. Adjustment/Test).

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AIRCRAFT ATTITUDE INDICATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic describes the procedure for checking that the aircraft attitude indicator, near the refuel control panel, displays an accurate indication of aircraft attitude.

Using a clinometer, the attitude of the aircraft in pitch and roll is obtained and then compared with that displayed by the bubble in the attitude indicator.

If the required degree of accuracy is not obtained, the indicator must be checked for correct installation and/or the indicator mounting bracket must be checked for distortion. If distortion of the bracket is suspected, the necessary repair action must be carried out.

This topic comprises a Functional Test. Operational and System Tests are not applicable.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Clinometer, capable of displaying accurately up to 1 minute of arc	-

B. Prepare

NOTE: The engines may be installed symmetrically or removed.

The aircraft may be on three-point jacks (with the landing gear up or down) or freely standing on the main and nose landing gear.

No one must be allowed on the aircraft during the test.

(1) Defuel the aircraft (Ref. 28-25-00, Servicing).

(2) Check that the bubble in the indicator is not larger than two squares of the grid.

C. Test

NOTE: The aircraft attitude is read in degrees and minutes of pitch and roll, using a clinometer placed centrally on the bottom of the fuselage keel at a mid-position between the main landing gear bay doors.

(1) Place the clinometer in position, orientated laterally to check the roll attitude. Check that the clinometer reading is within ±15 minutes of the reading obtained from the indicator bubble, interpolating between the squares to achieve the required accuracy.

(2) Orientate the clinometer longitudinally to check the pitch attitude. Check that the bubble in the indicator reads 1 deg 2 minutes (±20 minutes) nose-down, compared with the clinometer reading.

D. Conclusion

(1) Close the refuel control panel access door.

END OF THIS SECTION

NEXT

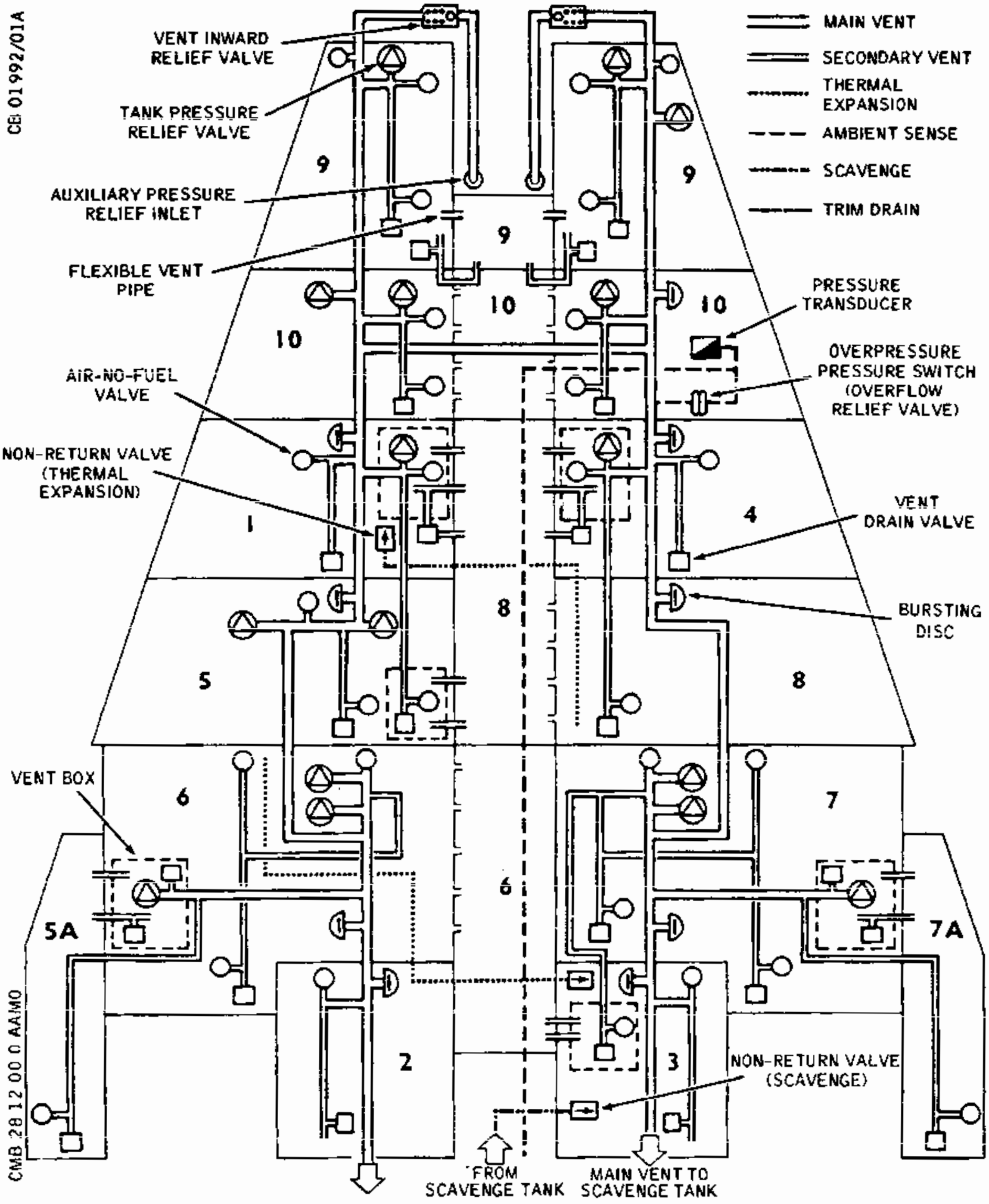
VENT AND PRESSURIZATION SYSTEM - DESCRIPTION AND OPERATION

R 1. General (Ref. Fig. 001, 002 and 003)

The fuel tanks are vented by a main gallery pipe which connects each tank to atmosphere through vents in the rear fuselage. At high altitude the tanks are pressurized to facilitate fuel pumping and to limit the possibility of fuel boiling. The vent and pressurization parts of the system are integrated and comprise a main vent gallery pipe which, in addition to venting the tanks, supplies them with air when they are pressure controlled. A scavenge system returns any fuel which overflows into the vent gallery to collector tank 3. Provision is made for thermal expansion of fuel, when heated during supersonic flight, by additional pipes which connect tank 8 to collector tank 1 and tank 6 to collector tank 3. Bursting discs are incorporated in the system for fuel tank overpressure protection and indication.

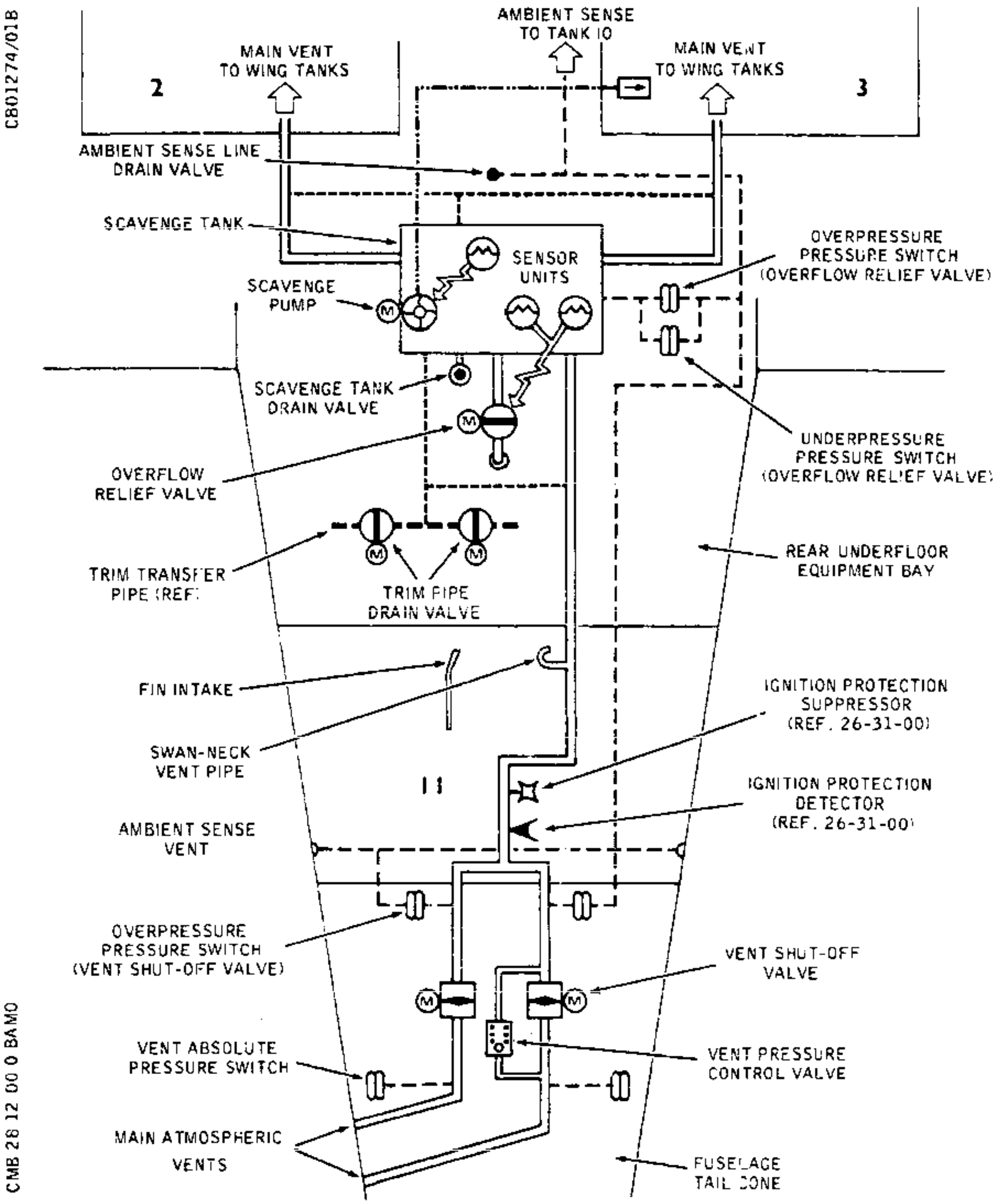
The main vent gallery comprises two main vent pipes interconnected by a balance in tank 10, and by a scavenge tank in the rear underfloor equipment bay. Branch pipes connect the gallery to the tanks through float-operated valves. The vent gallery is connected to atmosphere through five valve-controlled orifices: two main atmospheric vents in the tail cone through which the system is normally vented; an overflow relief vent in the rear fuselage undersurface, which vents the tanks if the two main vents are obstructed and also discharges overflow from the tanks; two auxiliary inward pressure relief inlets beneath tank 9, which allow air into the system when the main vent passages are obstructed by fuel from an overflowing tank.

Two electrically operated vent shut-off valves, one of which is connected in parallel with a pressure control valve, control the main atmospheric vents. Ram air
R from an intake on the fin is fed into the rear part of the vent system to pressurize the system. When the aircraft reaches an altitude of 44,000 ft, the vent absolute pressure switches signal the shut-off valves to close the main vent outlets. The pressure in the fuel tanks and vent system then rises to the pressure of the ram air or until the vent pressure control valve operates. If abnormal overpressure occurs in the vent gallery, the vent overpressure switches, connected between the gallery and atmosphere, operate to open shut-off valves. The overflow/relief
R vent is an electrically-operated overflow/relief valve controlled by overpressure and underpressure pressure
R switches and two level sensors in the scavenge tank. Two inward pressure relief valves control the two auxiliary inlets in the wing fairings beneath tank 9.



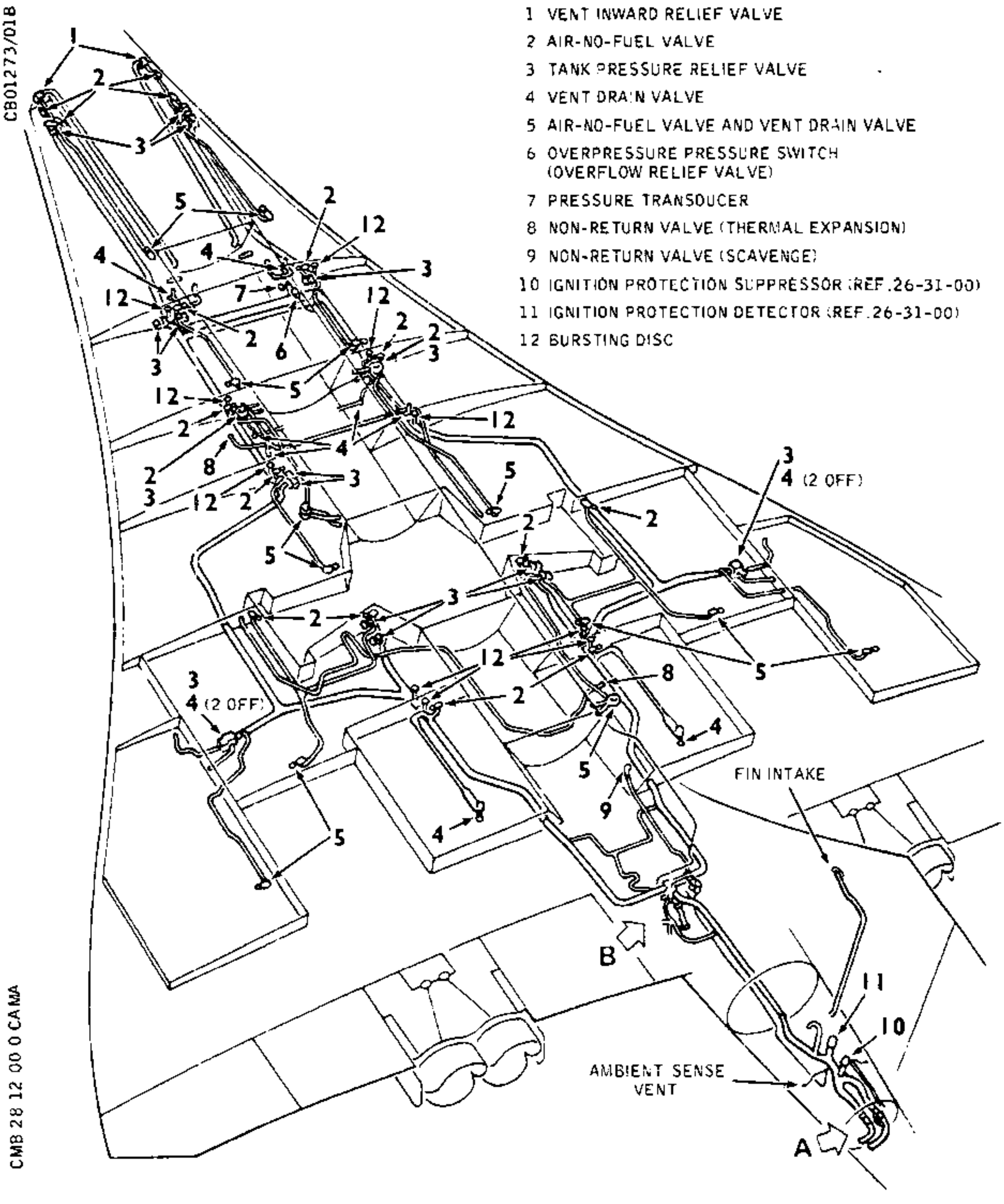
- Vent and Pressurization System (Forward) -
Schematic
Figure 001

R



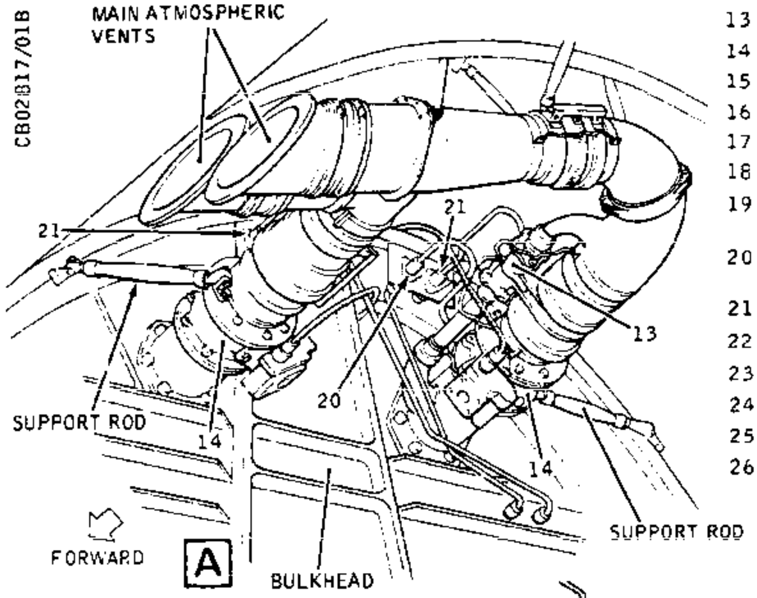
\- Vent and Pressurization System (Rear) -
Schematic
Figure 002

R

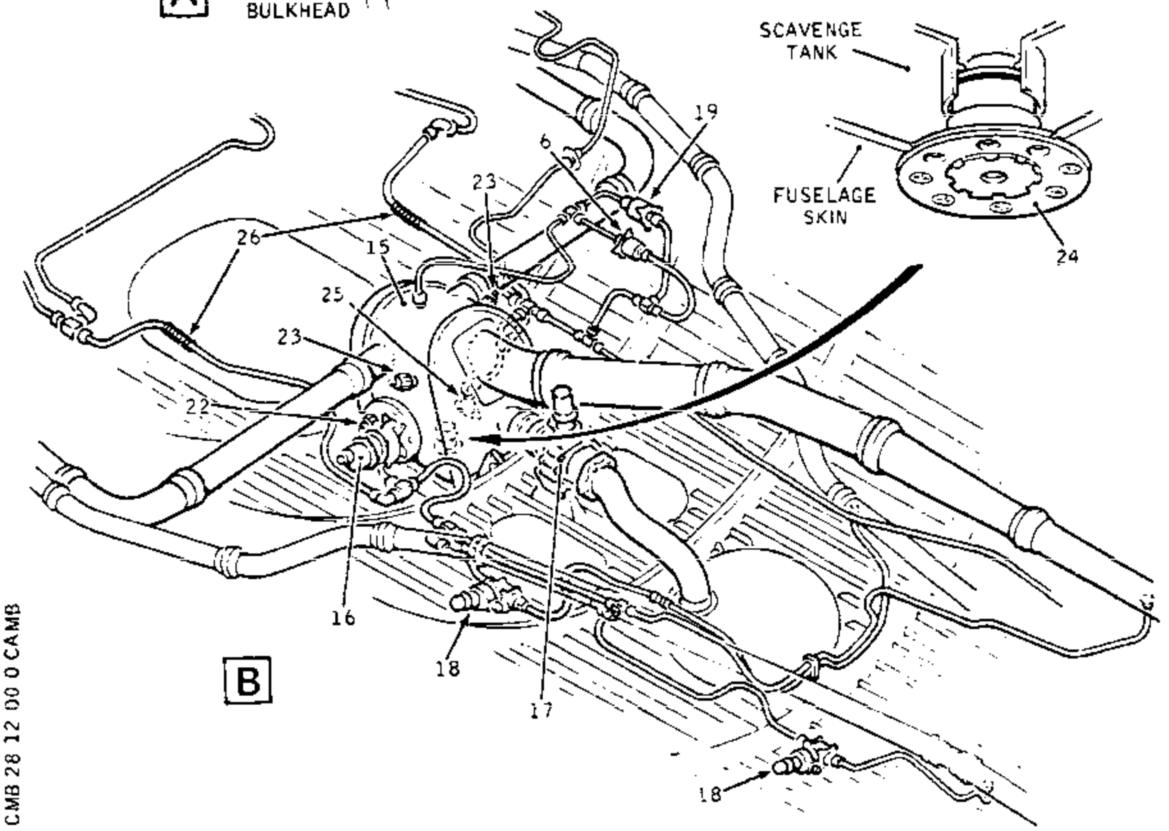


- Vent and Pressurization System - Component Location (Sheet 1 of 2)
Figure 003

R



13 VENT PRESSURE CONTROL VALVE
14 VENT SHUT-OFF VALVE
15 SCAVENGE TANK
16 SCAVENGE PUMP
17 OVERFLOW RELIEF VALVE
18 TRIM PIPE DRAIN VALVE
19 UNDERPRESSURE SWITCH (OVERFLOW RELIEF VALVE)
20 OVERPRESSURE SWITCH (VENT SHUT-OFF VALVE)
21 VENT ABSOLUTE PRESSURE SWITCH
22 SENSOR UNIT (SCAVENGE PUMP)
23 SENSOR UNIT (OVERFLOW RELIEF VALVE)
24 DRAIN VALVE (SCAVENGE TANK)
25 DRAIN VALVE (AMBIENT SENSE)
26 PROTECTIVE WRAPPING



\- Vent and Pressurization System - Component Location (Sheet 2 of 2)
Figure 003

R

R Pressures in the main vent gallery and at the main vents are transmitted to the appropriate pressure switches by small-bore pipes. Ambient pressure is tapped from two apertures in tank 11 structure and transmitted to the appropriate pressure switches and a pressure transmitter by small-bore pipes in the rear fuselage and right-hand wing fillet. A drain valve, beside the scavenge tank, allows any fluid accumulation in the ambient sense line to be drained overboard.

The four collector tanks, 1, 2, 3 and 4, are each connected to the main gallery directly by open-ended branch pipes and indirectly through an air-no-fuel valve and a vent drain valve. Tank 11 is connected to the gallery by an open-ended, swan-necked pipe. Gallery connections to tanks 5, 6, 7, 8, 9 and 10 are controlled by a combination of air-no-fuel valves, tank pressure relief valves and vent drain valves. These valves are mounted on branch pipes inside the tanks they control. Valves for tanks 5A and 7A, and the fuselage cells of tanks 6 and 8, are in sealed vent boxes in nearby tanks, adjacent to the controlled air space. Each vent box is also connected to the controlled air space by two short open-ended pipes. The centre cell of tank 9 is connected to the left and right cells of the tank by branch pipes and vent drain valves. Tanks 6, 8, 9 and 10, which have more than one cell, have high-level vent connections between cells: in the case of tank 9, these are short flexible pipes and for tanks 6, 8 and 10, they are holes in the tank structures.

Any fuel which overflows from the tanks into the vent gallery drains into the scavenge tank, which also collects fuel drainage from the trim transfer pipes through the electrically operated trim pipe drain valves. Fuel which collects at the lower points of the vent gallery drains directly into the scavenge tank through separate pipes. An electrically operated pump, mounted externally on the scavenge tank, returns fuel from the tank to collector tank 3 through the scavenge return pipe and a non-return valve. The scavenge pump is controlled by a level sensor in the scavenge tank which causes the pump to start when fuel in the tank reaches a predetermined level. A drain valve in the fuselage skin below the scavenge tank enables the tank to be drained.

R Tanks 6 and 8, which remain full for a considerable part of the supersonic cruise, are fitted with thermal expansion pipes which, if thermal expansion of fuel occurs, allow fuel to flow to tanks 1 and 3; non-return valves are fitted at the collector tank ends of these pipes, to prevent fuel from flowing back to the main transfer tanks.

Protection against tank overpressure, in all tanks except

tanks 5A, 7A, 9 and 11, is provided by bursting discs which are fitted in the main vent gallery in all other tanks.

A vent ignition detector and a vent ignition suppressor are mounted in the vent pipe in tank 11; these form part of the vent ignition protection system, which automatically senses and initiates a suppressive barrier against further progress of the flame (Ref. 26-31-00).

The vent system operates automatically, and is monitored at the fuel system management panel at the 3CM station by tank pressure and scavenge pump indication. A tank pressure indicator and an associated caption light are on the air data systems panel (Ref. 28-46-00). Electrical circuits provide a means of checking the operation of the vent shut-off valves, the overflow relief valve and the tank pressure relief valves; controls and indicators for these tests are on the refuel control panel, which is mounted forward of the main landing gear bays.

2. Air-no-fuel Valve (Ref. Fig. 004)

Two types of air-no-fuel valve are used: one type (Ref. Detail A) has captive bolts for its attachment, with its valve head operating outside the valve body and closing against a bush in the lower surface of the valve body; the other (Ref. Detail B) has floating anchor nuts for its attachment, with its valve head operating within the valve body and closing against a bush in the top surface of the valve body. A seal is fitted to the valve head on each of these types.

The valve body has two ports, one connecting with the vent pipe and the other connecting with the tank interior. A float-operated valve closes the tank port to prevent fuel from entering the vent system when the fuel level rises due to changes of aircraft attitude. The valves are mounted on manifolds high in the tanks to ensure that venting continues when the tanks are filled to the high level condition. Two or more of the valves are fitted in tanks 5, 6, 7, 8, 9 and 10, or in vent boxes in nearby tanks, to ensure that at least one valve in each tank remains in air space over the range of aircraft attitudes.

3. Vent Drain Valve (Ref. Fig. 005)

These valves, which are mounted on manifolds attached to the vent gallery branch pipes and the secondary vent pipes either in the tanks or in vent boxes in nearby tanks, comprise a float-operated pad valve controlling a port connecting the tank to the vent pipe. Any fuel which has entered the local part of the vent system drains back into the tank when the

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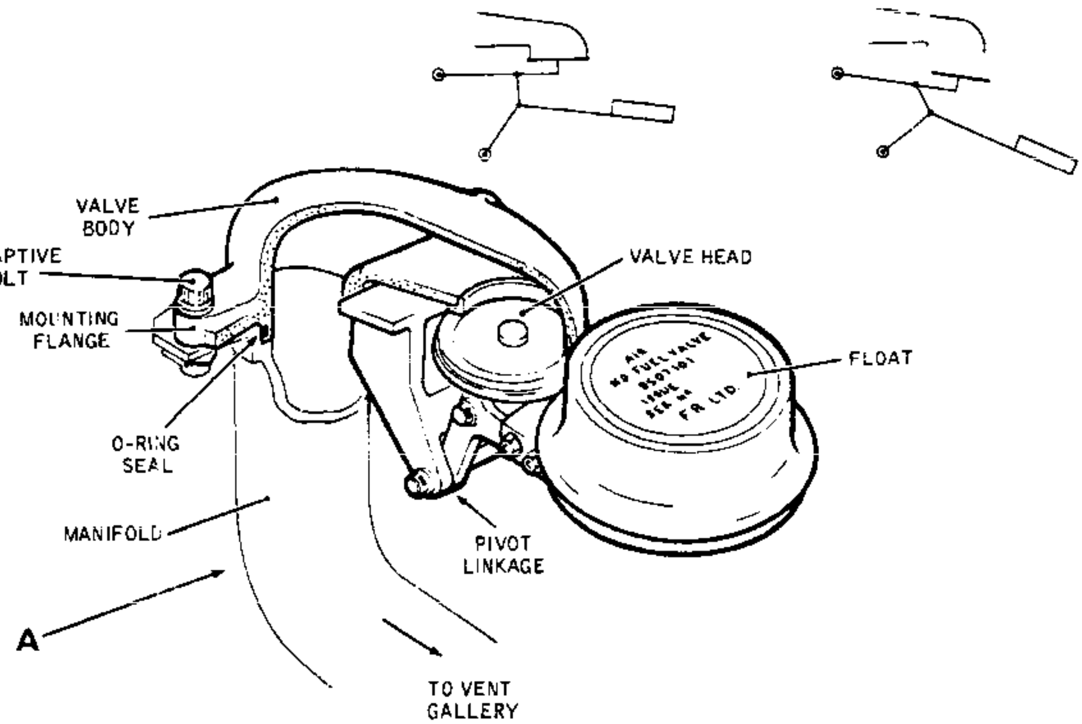
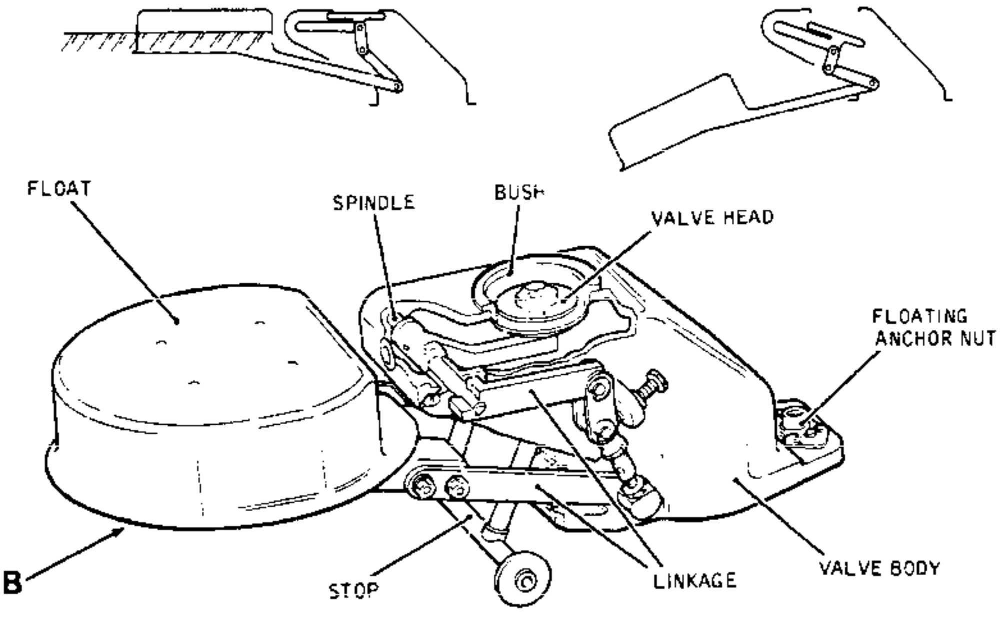
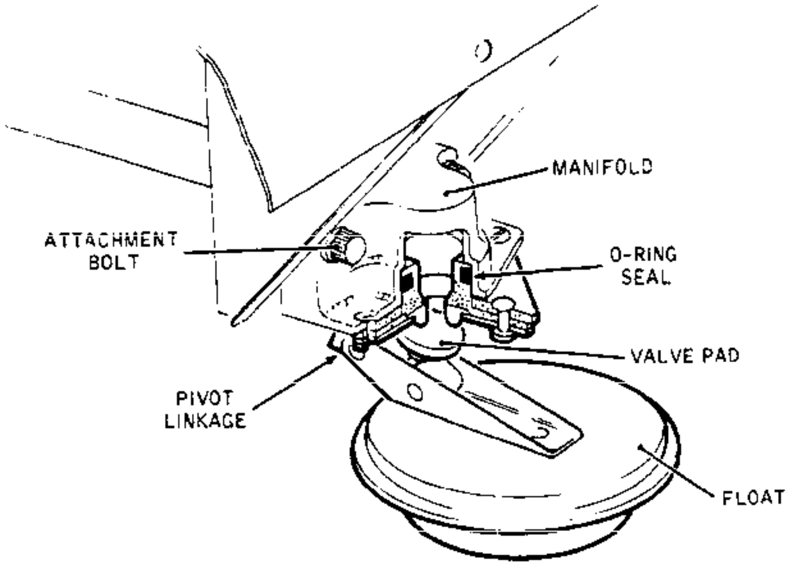




CMB 28 12 00 0 DAMO

R - Air-no-fuel Valves
Figure 004

valve is open.



Vent Drain Valve
R Figure 005

R 4. <u>Tank Pressure Relief Valve</u> (Ref. Fig. 006)

The valve body has three ports, one connecting with the vent pipe and two, which are of different sizes, connecting with the tank interior. Two float-operated valves, A and B, are mechanically linked to each other and to the float. When the float is in air space, the valves are both held open by the weight of the float; if the float is submerged, its buoyancy holds both valves closed to prevent spillage of fuel into the vent gallery due to aircraft acceleration or attitude. In the event of tank overpressure, the interconnection between the valves allows the pressure on the larger valve to overcome the combined pressure of the smaller valve and the lift of the float, causing both valves to open. With underpressure conditions in the tank, the pressure in the vent gallery opens the smaller valve, sinks the float and holds the larger valve closed, thus preventing the differences between the tank and vent system pressures exceeding predetermined values.

R The valves are mounted high at the front of the tanks, or in vent boxes in nearby tanks, to prevent inadvertent opening when the aircraft climbs and to limit fuel loss due to fuel static level if a valve fails to open. Only one valve is fitted in tanks 5A and 7A since the tanks are never replenished during flight. Tanks 5, 6, 7, 8, 9 and 10 have more than one valve to ensure adequate protection, if a valve fails, against pressure produced if fuel overflows either during refuelling or during tank-to-tank transfer. Each TPRV has an electrical position switch to enable its open position to be confirmed when the tank is empty before refuelling.

R 5. Vent Inward Relief Valve (Ref. Fig. 007)

The valve comprises upper and lower housings which contain a spring-loaded poppet valve assembly and a push/pull spindle. The housing has two ports, one connecting the underside of the poppet valve to atmosphere and the other forming a flange for securing the valve to the vent gallery pipe at the front wall of tank 9.

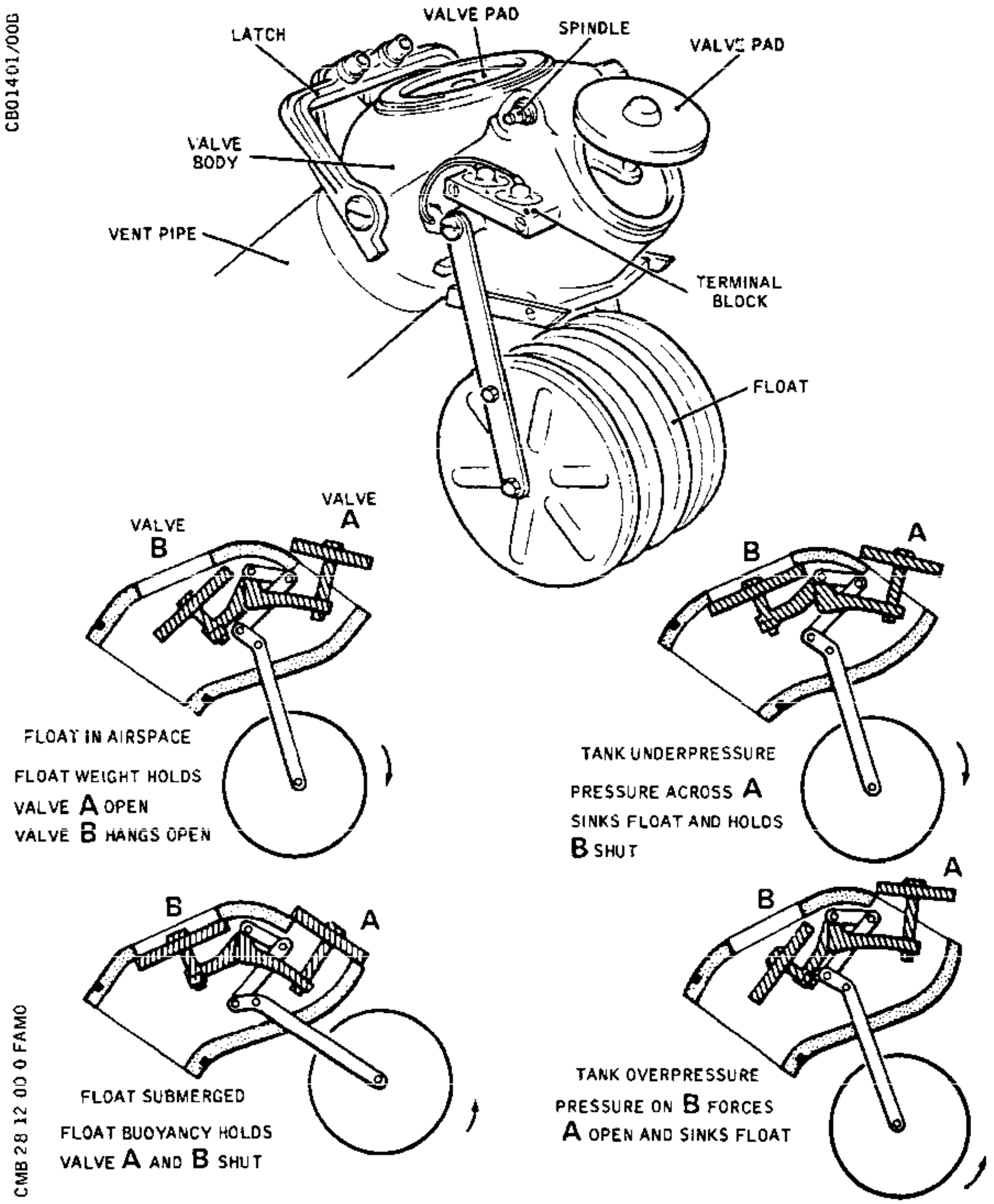
The poppet valve is normally held closed by its spring, but it opens to allow air into the gallery when ambient pressure
R exceeds gallery pressure by 0.8 psi (0.055 bar). The push/pull spindle enables the operation of the valve to be checked. A lockpin on the spindle can be released to allow the spindle to be moved to open or close the valve. Engraved lines on the spindle, which become visible below the valve body, give visual indication of valve open and shut positions. Two of
R these valves are fitted, mounted externally on the front walls of the left and right cells of tank 9.

R 6. Vent Shut-off Valve (Ref. Fig. 008)

The body of the valve assembly forms part of the main gallery pipe in the tail cone. It contains a butterfly valve which is operated through an electrical actuator mounted on the valve body and controlled by limit switches. When the valve is open, the tanks and gallery are vented to atmosphere; when the valve is closed the gallery and tanks are pressure-controlled. Visual indication of valve position is provided by a line, which is visible through a window, registering with open and
R shut markings on the actuator. A NOT OPEN caption, on the
R refuel control panel, is illuminated when the valves are shut.

R 7. Vent Pressure Control Valve (Ref. Fig. 009)

The valve body houses a spring-loaded piston, operated
R in a ported sleeve, and incorporates separate inlet and



\- Tank Pressure Relief Valve
Figure 006

R

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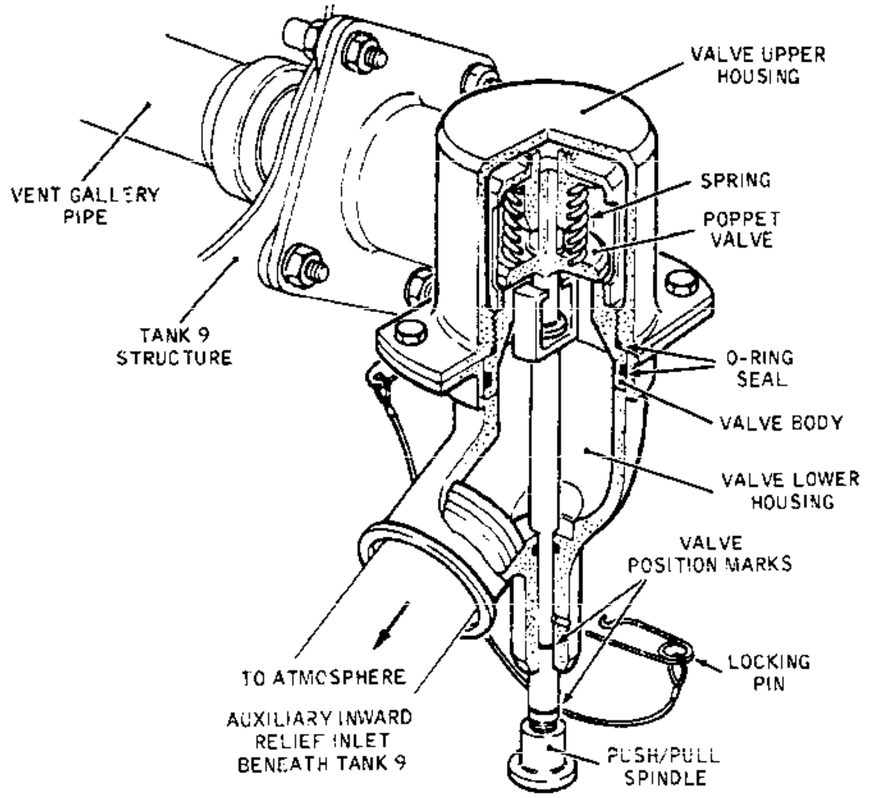

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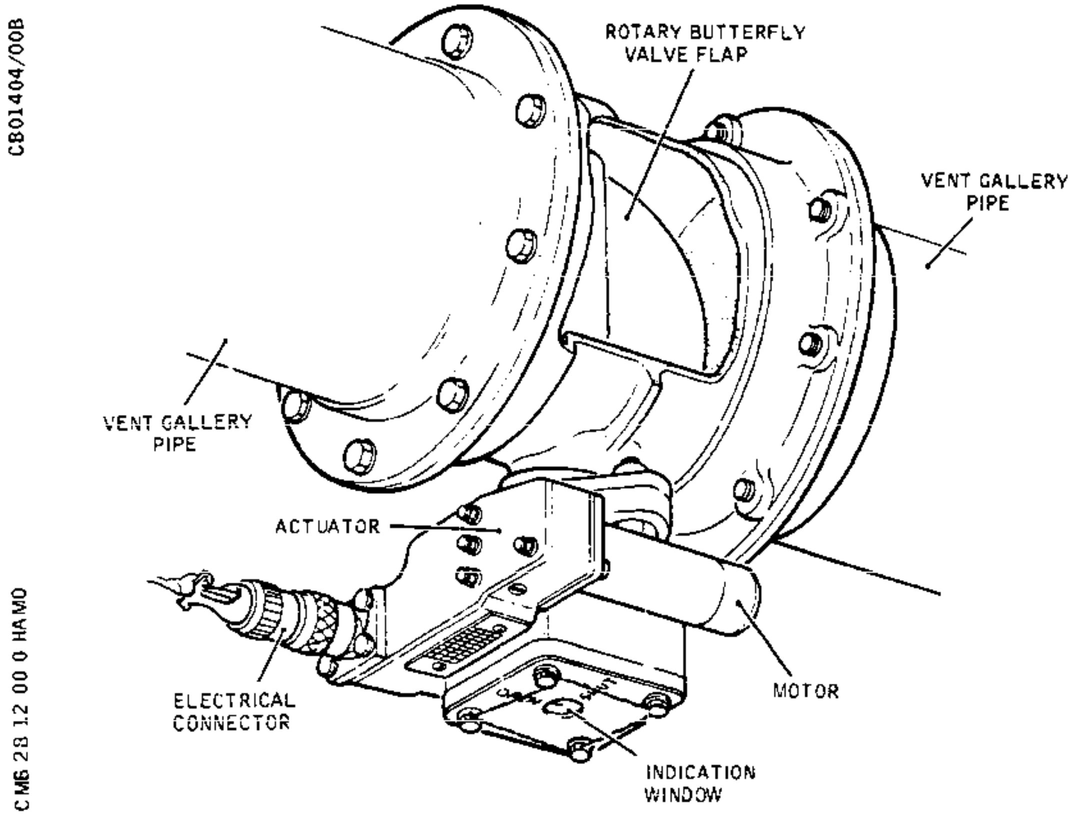
\- Vent Inward Relief Valve
R Figure 007

outlet connections. An arrow marked on the valve body indicates the direction of flow. The valve is fitted in parallel with the vent shut-off valves and controls tank
R pressure so that the tank air pressure, on the upstream side
R of the valve, is maintained at approximately 2.2 psi
R (0.152 bar) above ambient and allows excess air to by-pass the shut-off valves and exhaust into the atmosphere.

8. Vent Overpressure Switch (Vent Shut-off Valve)

R This is a diaphragm-type switch which operates a micro-switch through a spring-loaded linkage in response to pressure difference between ambient and tank. One side
R of the diaphragm senses ambient air pressure and the opposite side senses tank pressure. As tank pressure rises, the micro-
R switch contacts open at a pressure of 3.75 (+0 -0.2) psi
R (0.258 (+0 -0.013) bar). As tank pressure falls, the micro-switch contacts close at a minimum pressure of 2.75 psig
R (0.189 bar). Each of these two switches controls one of the vent shut-off valves if abnormal overpressure is created in the vent gallery.



Vent Shut-off Valve
R Figure 008

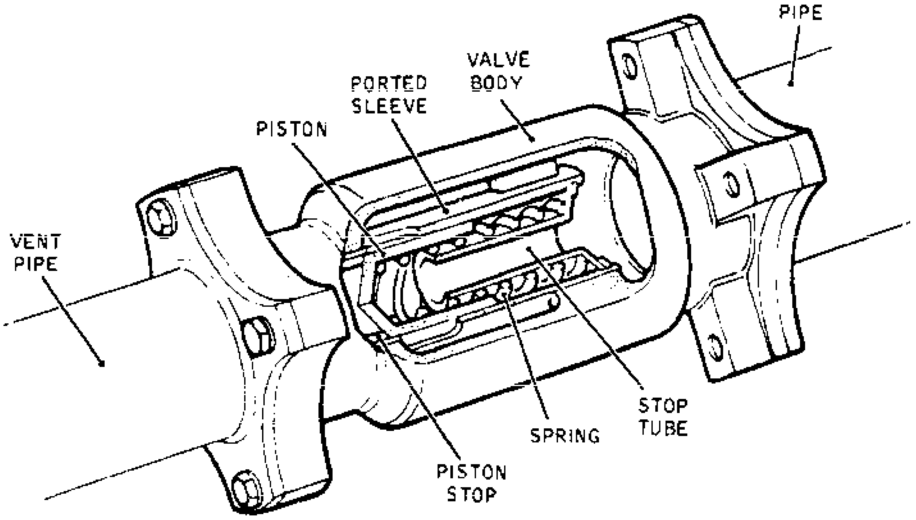
R The pressure switch is similar to that illustrated in 28-13-00,
R Description and Operation, but does not have a flame trap
R fitted.

9. Vent Absolute Pressure Switch

This switch is similar to the vent overpressure switch, and operates in response to changes in absolute pressure at the
R main atmospheric vents. One side of the diaphragm is a sealed capsule and the opposite side senses ambient air pressure. As ambient pressure falls and rises, the micro-
R switch contacts change over at a pressure of 2.35 (+or-0.3)
R psi (0.162 (+or-0.021)) absolute. This switch controls the operation of the vent shut-off valves during normal operations.

R 10. Vent Ignition Protection Detector (Ref. 26-31-00)

The detector is a hermetically sealed unit which is sensitive to visible and infra-red radiation from burning hydrocarbon fuel. It provides a signal which discharges the contents of a vent ignition protection suppressor if combustion of fuel



Vent Pressure Control Valve
R Figure 009

vapour occurs at the main atmospheric vents.

R 11. Vent Ignition Protection Suppressor (Ref. 26-31-00)

The suppressor is a canister containing dibromodifluoromethane. An electrically fired detonator ruptures the
R canister end cap to discharge the suppressant.

12. Overflow Relief Valve (Ref. Fig. 010)

The valve body forms a part of a branch pipe off the main gallery pipe and houses a rotary valve plug which is driven by an electric actuator. The actuator is mounted on the valve body and contains a motor, which has a pre-set clutch to protect it from overloading, and a gearbox which drives the output shaft. The output shaft drives the valve plug to either the open or the shut position, and also operates limit switches which control the valve travel and give remote indication of the valve plug position. A window in the actuator enables a visual check to be made
R of the valve plug position; either letter O or letter S appears, depending on whether the valve is open or shut.

Indication of the valve position is also given by a magnetic indicator on the refuel control panel.

The valve, which is mounted immediately behind the scavenge tank, opens to allow inward or outward venting of the gallery and tanks, and discharges fuel overboard in the event of a tank overflowing into the gallery pipes.

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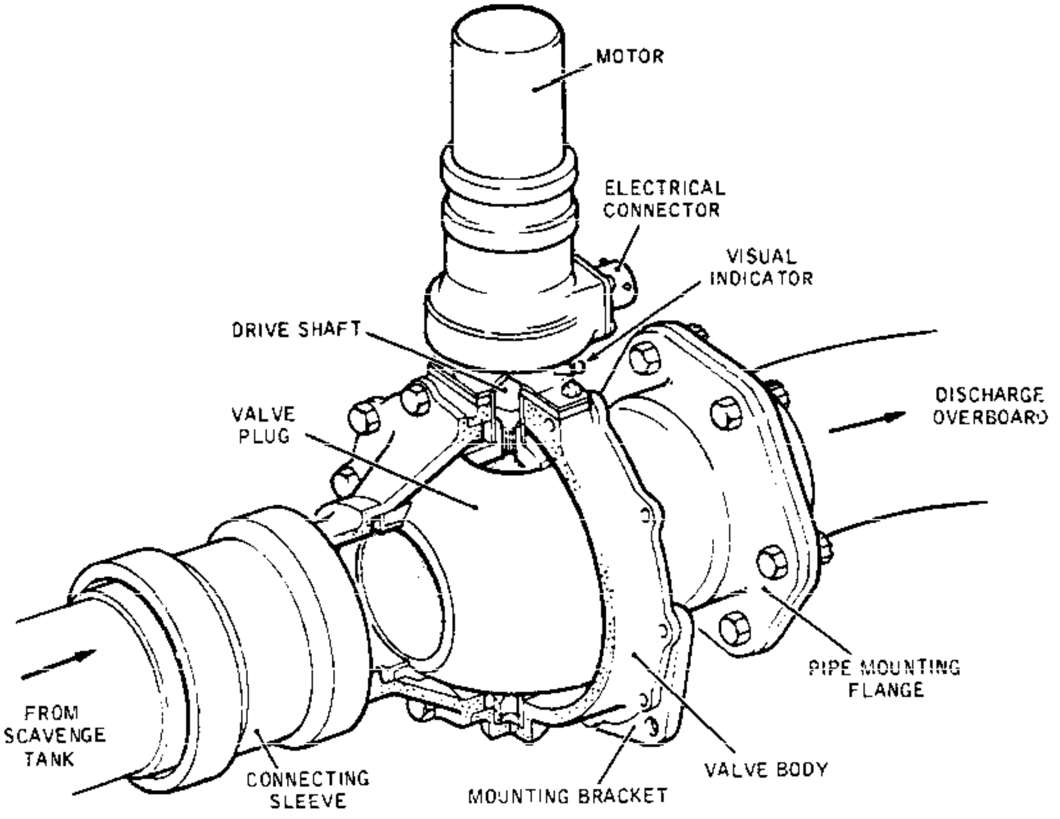

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R Overflow Relief Valve
Figure 010

R 13. <u>Overflow Relief Valve Sensor Units</u> (Ref. Fig. 011)

Two sensor units are used to provide one of the means of controlling the overflow relief valve, via a channel of a level switching pack. The sensors have threaded bodies and are mounted on the scavenge tank. The basic element of a sensor is a thermistor connected in the earth lead and heated by the current passing through it; when the thermistor is immersed in fuel its temperature falls and its resistance increases with a resultant change in output signal. The unit therefore senses the level of fuel in the scavenge tank. In addition to the thermistor, the unit contains resistors which provide a constant d.c. current, a temperature-compensating

circuit, a resistor which limits the thermistor temperature and diodes which safeguard the sensor against faulty connections.

14. Vent Underpressure and Overpressure Switches (Overflow Relief Valve)

These switches are similar to the vent shut-off valve overpressure switch. There are two overpressure switches, one in the forward part of the vent gallery and the other in the rear part of the vent gallery. One side of each switch senses
R pressure: as tank pressure rises, the microswitch contacts
R close at a pressure of 3.0(+0 -0.2) psig (0.206(+0 -0.013)
R bar), and, as tank pressure falls, the contacts open at
R 2.0(+0.5 -0) psig (0.138(+0.034 -0) bar).

The underpressure switch senses pressure in the rear part of the vent gallery; one side of the switch senses tank air pressure and the other side senses ambient pressure. As tank pressure falls the microswitch contacts close at a negative
R pressure of -1.5(+0 -0.1) psig (-0.103(+0 -0.006) bar).
R As tank pressure rises, the microswitch contacts open at a
R negative pressure of -0.7 psig (-0.048 bar). These switches control the operation of the overflow relief valve.

15. Scavenge Pump (Ref. Fig. 011)

The pump body houses a radial impeller driven by an electric motor. The pump draws fuel through a central inlet and delivers it through a single outlet into the scavenge return
R pipe. Part of the delivery flow is circulated around the pump bearings and rotor for cooling and lubrication purposes; this flow is discharged into the scavenge tank, together with vapour from the impeller, through a single outlet located above the pump inlet.

R The motor, comprising a rotor and a wound stator, is a 3-phase
R star-connected, squirrel cage induction machine. The star
R connection is made through a thermal switch mounted on the
R stator housing and a thermal fuse is incorporated in each
R stator winding. Electrical connections to the motor are made
R via a three-pin connector mounted on a lead-wire cover assembly
R which is attached to the stator housing.

R If the temperature of the motor rises to 135 to 147 deg C
R (275 to 296 deg F) the thermal switch contacts open to
R interrupt the supply to the stator windings. When the
R temperature of the motor has cooled to 104 to 114 deg C
R (219 to 237 deg F) the thermal switch contacts close to
R reinstate the supply to the stator windings.

R The thermal fuses rupture at 202 deg C (392 deg F).

R 16. Scavenge Pump Sensor Unit (Ref. Fig. 011)

This sensor unit, which is similar to those used for control of the overflow/relief valve, controls the operation of the scavenge pump via a channel of a level switching pack. The unit is mounted in the scavenge tank and the pump is automatically switched on when fuel is sensed within the tank, and a time delay device causes the pump to continue running for 30 s after the fuel level has fallen below the sensor.

17. Scavenge Non-return Valve

R This is a spring-loaded poppet-type valve, mounted under tank 3. The inlet side of the valve is connected to the scavenge return pipe and the outlet side to the tank. An arrow on the valve body indicates the direction of flow. The valve prevents fuel from the tank from entering the scavenge system.

R 18. Pressure Transducer

R The pressure transducer forms part of the tank air pressure indication system (Ref. 28-46-00).

R 19. Thermal Expansion Non-return Valve (Ref. Fig. 012)

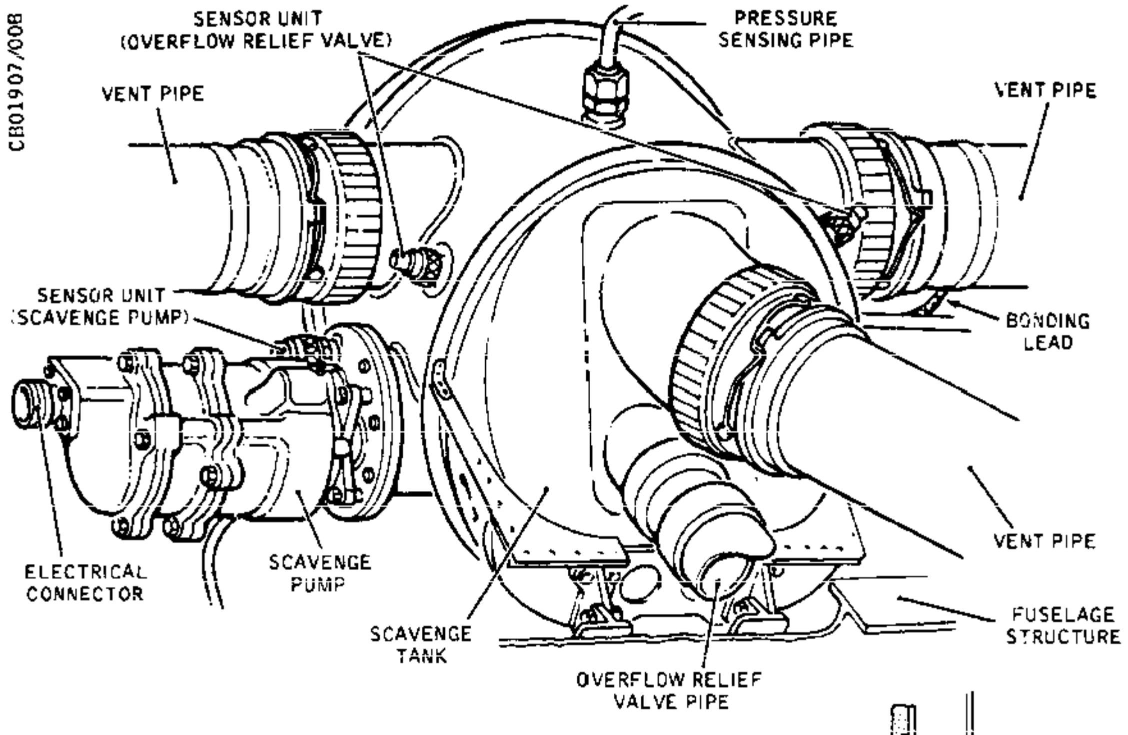
The valve assembly is a hinged non-return flap valve, the flap being spring-loaded to allow fuel to flow in one direction only. The direction of flow, when the valve is unseated, is indicated by an arrow on the valve body.

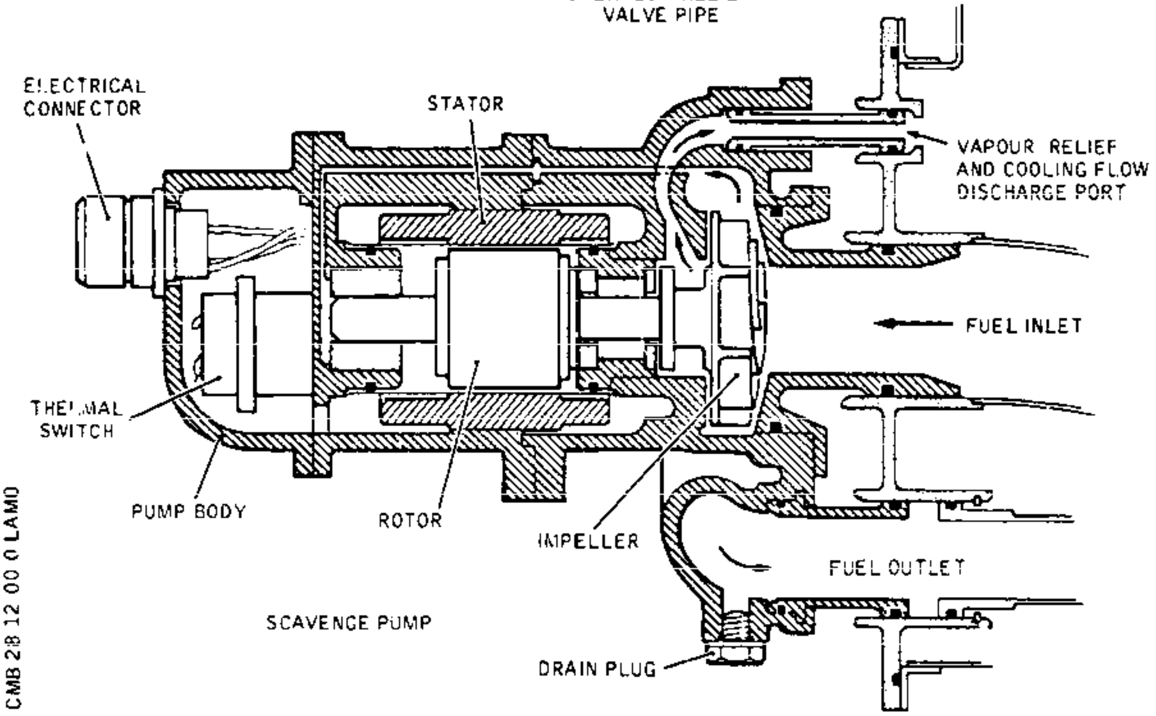
R 20. Ambient Sense Line Drain Valve (Ref. Fig. 013)

The valve body encloses a spring-loaded valve slide and incorporates a flange for mounting the valve and a connector for attaching the valve to the sense line. For draining
R purposes the slide is lifted, against a spring, by a drain tool; in this position any fluid in the sense line is drained through the tool via ports in the slide.

R 21. Trim Pipe Drain Valve (Ref. Fig. 014)

The valve body houses a rotary, two-position valve plug, which is driven by an electric motor through a reduction gearbox. A pre-set clutch protects the motor against overloading and internal limit switches are used to limit the extent of travel and operate a remote indicator. Flanges on the valve are bolted to mounting brackets on a mounting





R - Scavenge Tank and Scavenge Equipment
Figure 011

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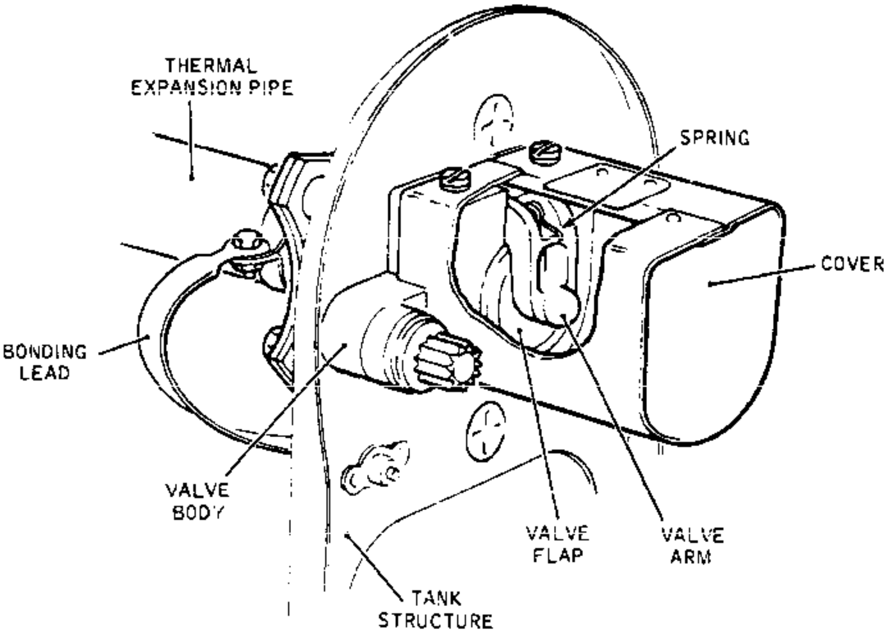

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Thermal Expansion Non-return Valve
R Figure 012

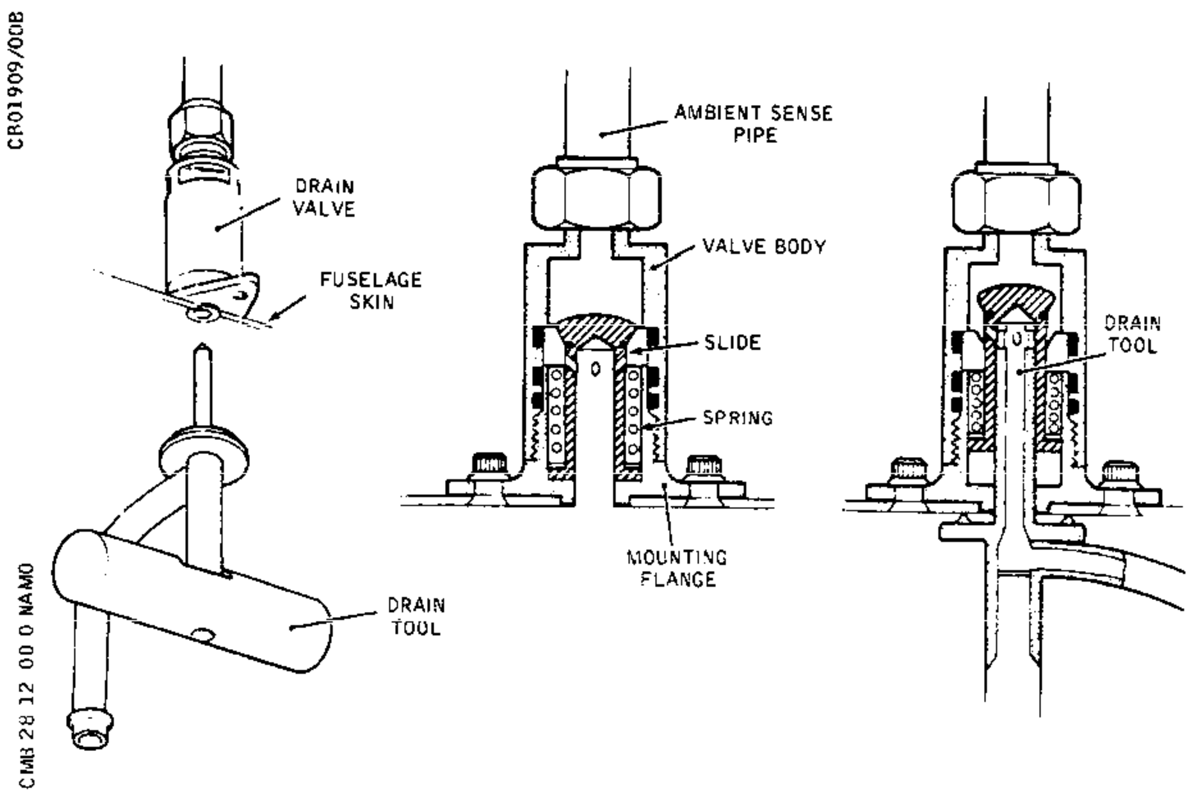
plate. The mounting plate forms part of the aircraft structure aft of the scavenge tank. A mechanical lever type of position indicator is fitted, the lever registering with 'open' and 'shut' markings on the valve to correspond with the valve position. Indication of the position of the valves is also given by a magnetic indicator on the fuel system management panel.

Two of these valves are fitted and both are controlled from a single switch on the management panel. The valves allow any fuel in the trim transfer pipes to be fed to the engines, drain the trim transfer pipes for maintenance purposes and permit a pre-flight check of the scavenge system.

22. Operation

A. Aircraft on Ground

When all the fuel tanks are empty or partially full, all tank-mounted valves and the vent shut-off valves are open, and the inward pressure relief valves, the overflow/relief valve (ORV) and the pressure control valve are

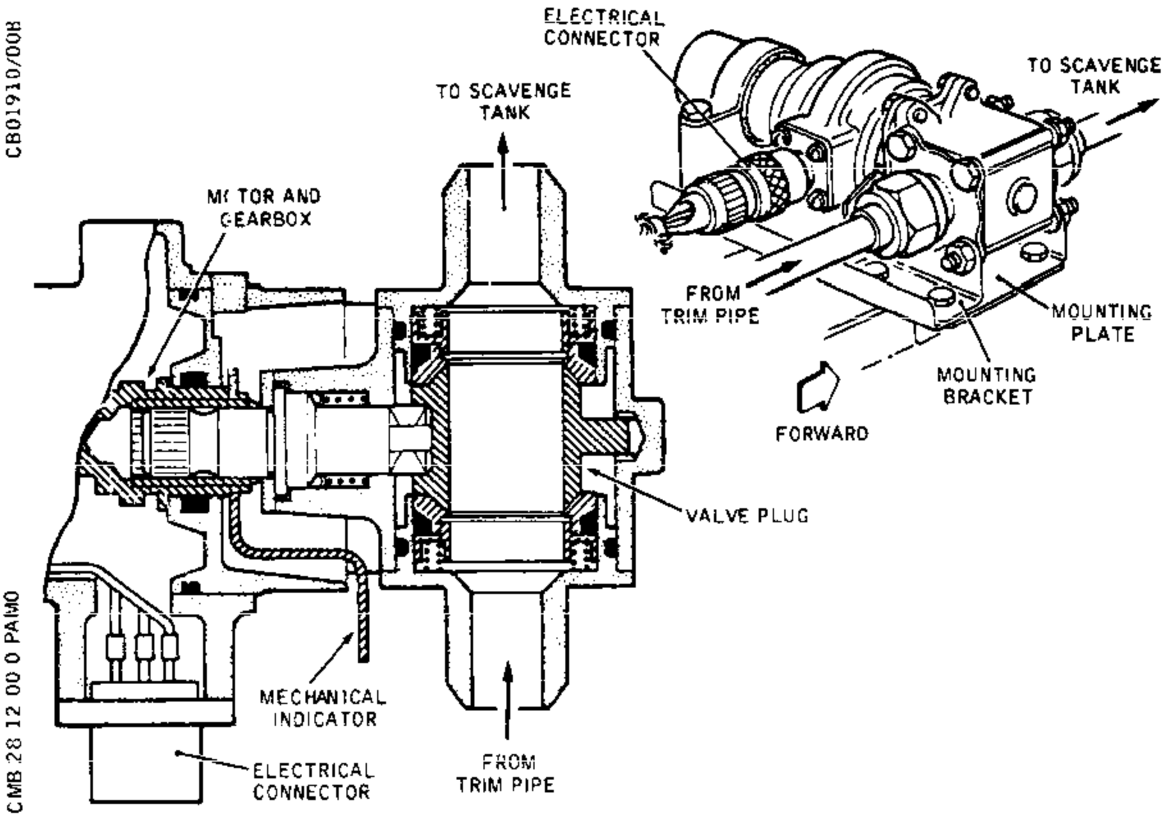


\- Ambient Sense Line Drain Valve
R Figure 013

shut. All tanks are therefore vented to atmosphere and tank pressure is equal to ambient pressure.

During refuelling, air and fuel vapour is vented to atmosphere through the air-no-fuel valves, tank pressure relief valves (TPRVs) and vent shut-off valves. The rising fuel level closes all except one of the air-no-fuel valves in each tank, except tank 11, and, when the tank is full, also closes the TPRVs in each tank except tanks 5A and 7A (TPRVs for tanks 5A and 7A are in the vent boxes). Tanks 1, 2, 3 and 4 do not have TPRVs, but have open-ended branch pipes for pressure relief. Tank 11
R has no valves and is vented to atmosphere through a
R swan-neck pipe into the vent gallery.

If fuel overflows from a tank, its TPRV reopens, overflowing fuel spills into the vent gallery and drains into the scavenge tank. Overflowing fuel from the four collector tanks and tank 11 passes directly into the vent gallery through the open-ended vent pipes. The fuel enters the scavenge tank and is pumped to collector tank 3. If a large quantity of fuel passes into the scavenge



\- Trim Pipe Drain Valve
R Figure 014

tank, the sensors open the ORV and the fuel is discharged overboard. The ORV closes when the scavenge tank fuel level falls below the sensors.

B. Aircraft in Flight

As the aircraft climbs, the tanks vent freely to atmosphere until an atmospheric absolute pressure of 2.35 psi (0.162 bar) (altitude of approximately 44,000 ft) is reached. At this altitude, the vent absolute pressure switches close the vent shut-off valves to isolate the tanks from atmosphere. Tank air pressure then builds up under the effect of ram air from the fin intake. When the pressure reaches 1.65 psig (0.114 bar) it is held at this value by the vent pressure control valve, which releases excess pressure to atmosphere. This ensures a minimum tank pressure of 2.2 psi (0.152 bar) absolute up to the maximum altitude of the aircraft.

If, at any altitude, tank air pressure rises to 3.0 psig (0.206 bar), the vent overpressure pressure switch is operated to open the ORV and vent the tanks to atmosphere.

If the ORV fails to open with an overpressure condition above 44,000 ft, the vent shut-off valves open, by means of their overpressure pressure switches, when tank air pressure reaches 3.75 psig (0.258 bar).

If a tank overflows, as a result of fuel transfer, the resultant overpressure in the vent gallery opens the ORV, which stays open until the fuel level in the scavenge tank falls below the ORV sensors. The ORV will then close if gallery pressure has returned to normal.

As the aircraft descends, the vent shut-off valves reopen at 2.35 psia (0.162 bar) (approximately 44,000 ft), and the tanks are again freely vented. If either or both valves fail to open and tank pressure drops to minus 0.8 psig (0.055 bar), the vent inward relief valves open. If tank pressure drops to minus 1.5 psig (0.103 bar) the vent underpressure pressure switch opens the ORV, which allows inward venting. If the ORV also fails to open, the rate of descent must be decreased to prevent excessive negative pressures in the tanks; tank pressure is monitored by a caption light and gauge on the air data systems panel.

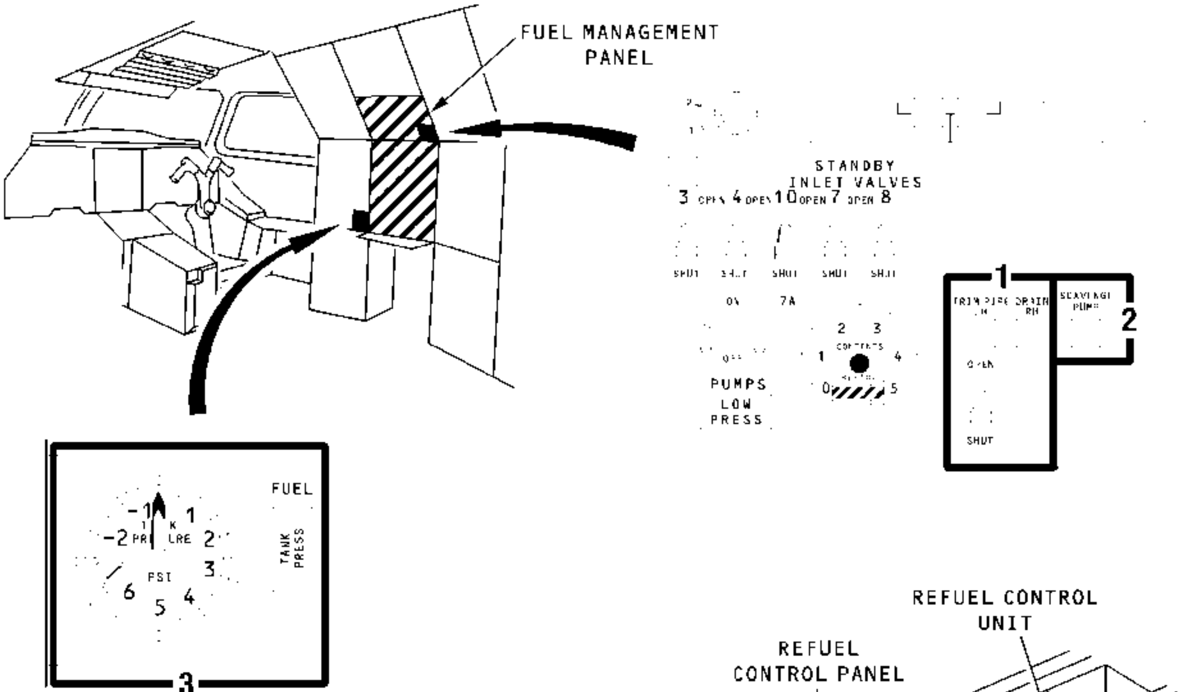
C. Control and Indication (Ref. Fig. 015)

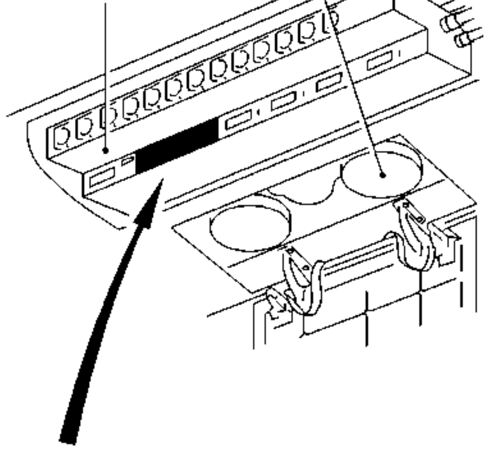
The control switches and indicators for the vent and pressurization system are on the fuel management, refuel control and air data systems panels. Controls and indicators for trim pipe drain valve operation and indicators for scavenge pump operation are on the fuel management panel; ground test facilities for the overflow relief, tank pressure relief and vent shut-off valves are on the refuel control panel; the tank pressure indicator and associated caption light are on the air data systems panel.

An OPEN/SHUT switch controls the two trim pipe drain valves. The control switch is locked in the SHUT position and must be pulled out against spring tension before OPEN is selected. Each valve has a magnetic indicator which displays OPEN or SHUT in accordance with switch operation and diagonal stripes when the valve is de-energized or in transit.

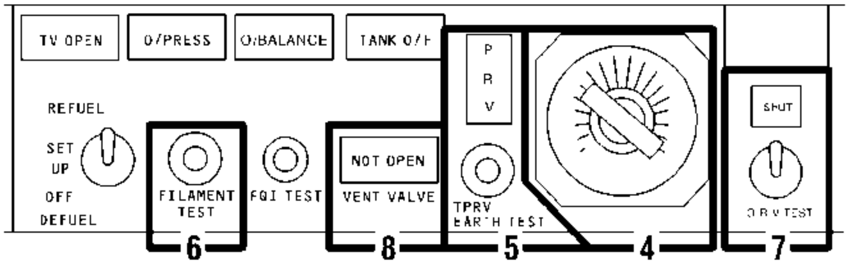
The scavenge pump magnetic indicator, energized via the pump control relay, shows the ON or OFF operating condition of the pump as selected by the fuel level switching pack and the associated level sensor unit.

The tank pressure relief valve circuit is tested by using the TRPV selector switch and TPRV EARTH TEST push-switch. The green PRV caption is illuminated to indicate that the





1 TRIM PIPE DRAIN VALVE SWITCH AND INDICATORS
2 SCAVENGE PUMP INDICATOR
3 TANK PRESSURE INDICATOR
4 TANK PRESSURE RELIEF VALVE SELECTOR SWITCH
5 TANK PRESSURE RELIEF VALVE SWITCH AND CAPTION LIGHT
6 FILAMENT TEST SWITCH
7 OVERFLOW/RELIEF VALVE TEST SWITCH AND INDICATOR
8 VENT VALVE CAPTION LIGHT



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Vent and Pressurization System - Controls and Indicators
Figure 015

R

valves are open.

The position of the vent shut-off valves is shown by an amber NOT OPEN caption. This is illuminated when either one or both valves are not open. The caption light has a dimming facility incorporated.

The overflow relief valve circuit is tested using the ORV TEST switch in conjunction with the associated magnetic indicator, which shows whether the valve is OPEN or SHUT.

Depressing the FILAMENT TEST push-switch tests the filaments of all the caption lights on the refuel control panel.

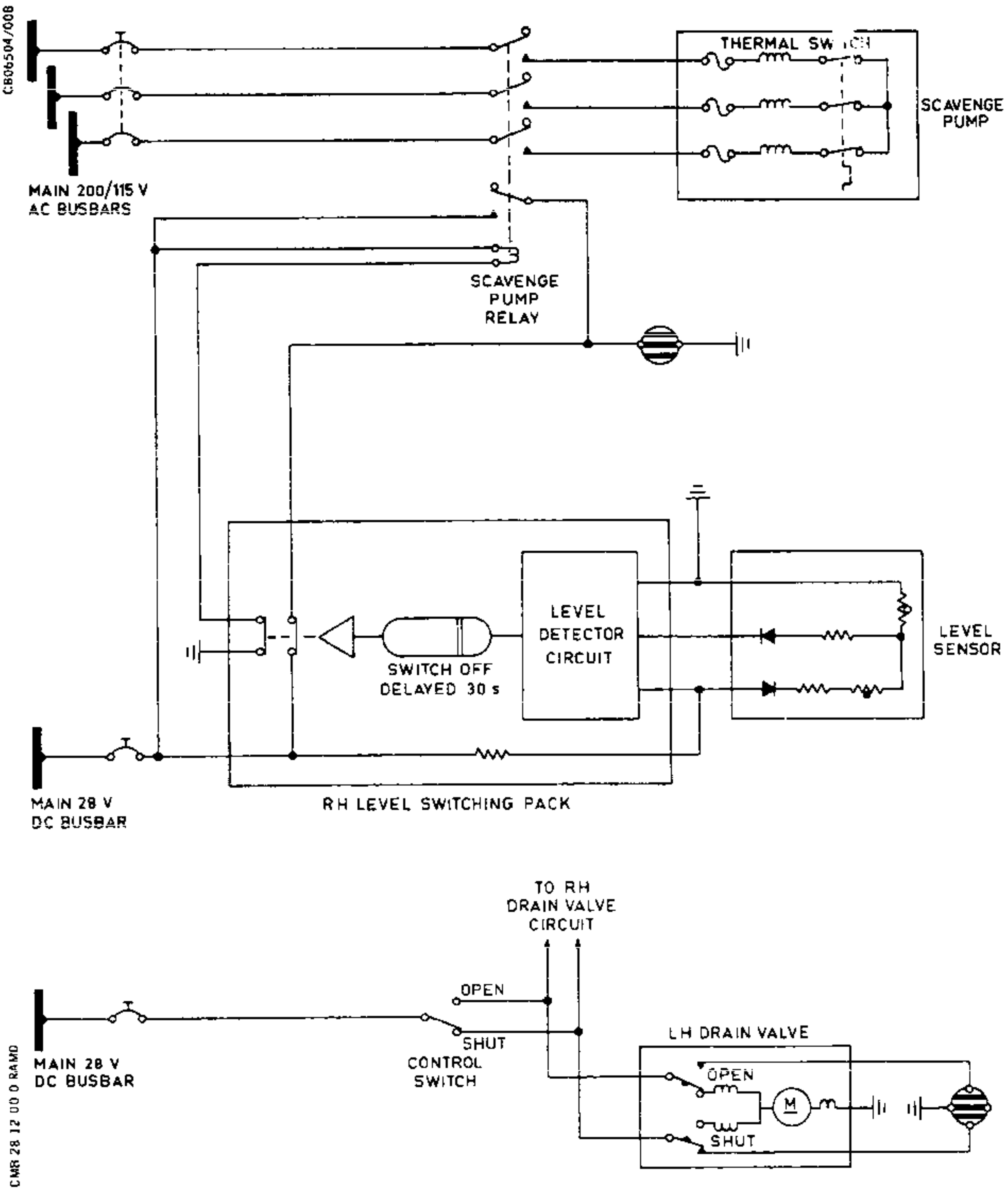
D. Functional Description

The two trim pipe drain valves are operated when the control switch supply is connected to either the open or shut valve motor windings through limit switches on the valves (Ref. Fig. 016). At the end of valve travel the limit switches operate, one to transfer the supply to the appropriate indicator connector, the other to arm the valve for the reverse operation.

The scavenge pump is controlled automatically through a relay in the level switching pack in response to signals from a level sensor in the scavenge tank (Ref. Fig. 016). When fuel is detected in the scavenge tank by the sensor element, the pump relay is closed and the pump operated until the tank is empty. A time delay device maintains pump operation for 30 s beyond the time of the sensor cut-off signal, to ensure that the tank is completely empty. When electrical power is first switched on, the scavenge pump will operate for 30 s. This is due to
R the 'warming up' characteristic of the sensor.

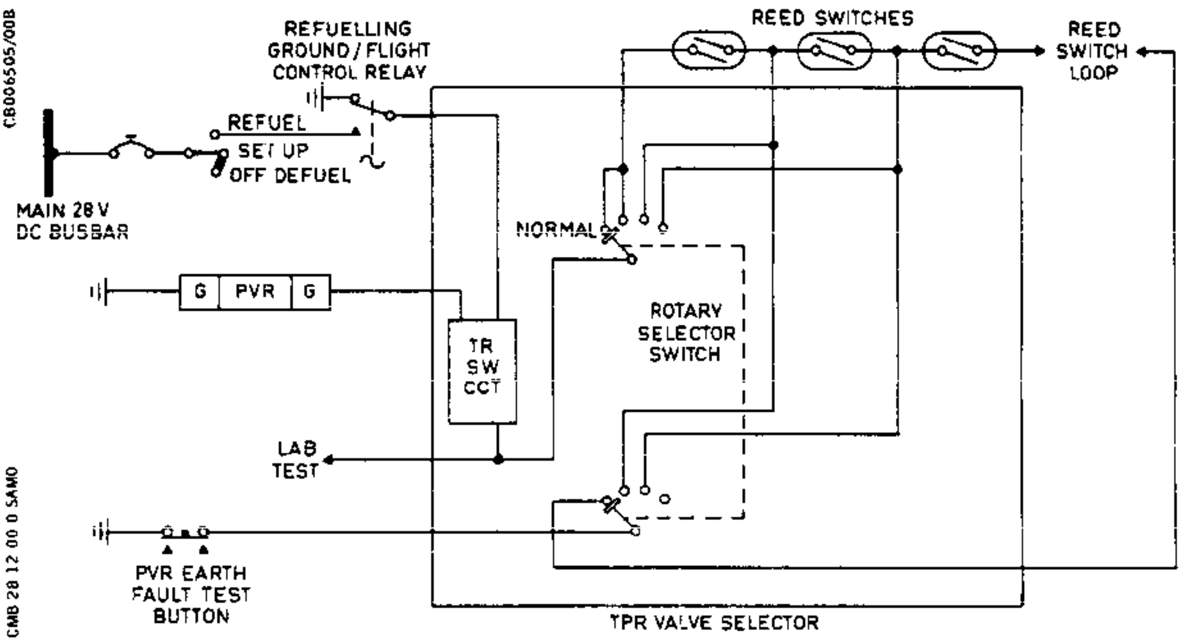
The tank pressure relief valves are electrically connected in series through a closed reed switch in each valve when the valves are open (Ref. Fig. 017). With the rotary switch at NORMAL, all the valves are checked in the open position by a transistorized switch circuit. This circuit, on sensing an earth, causes the green PRV caption to be illuminated. If the caption fails to become illuminated independent valve checks can be made, using the selector switch in the appropriate position. Freedom from stray earths can be verified by depressing the TPRV EARTH TEST push-switch.

The overflow relief valve, normally closed, is operated through a relay controlled by the ORV test switch, two



- Vent System Drain - Control and Indication -
Simplified Schematic
Figure 016

R

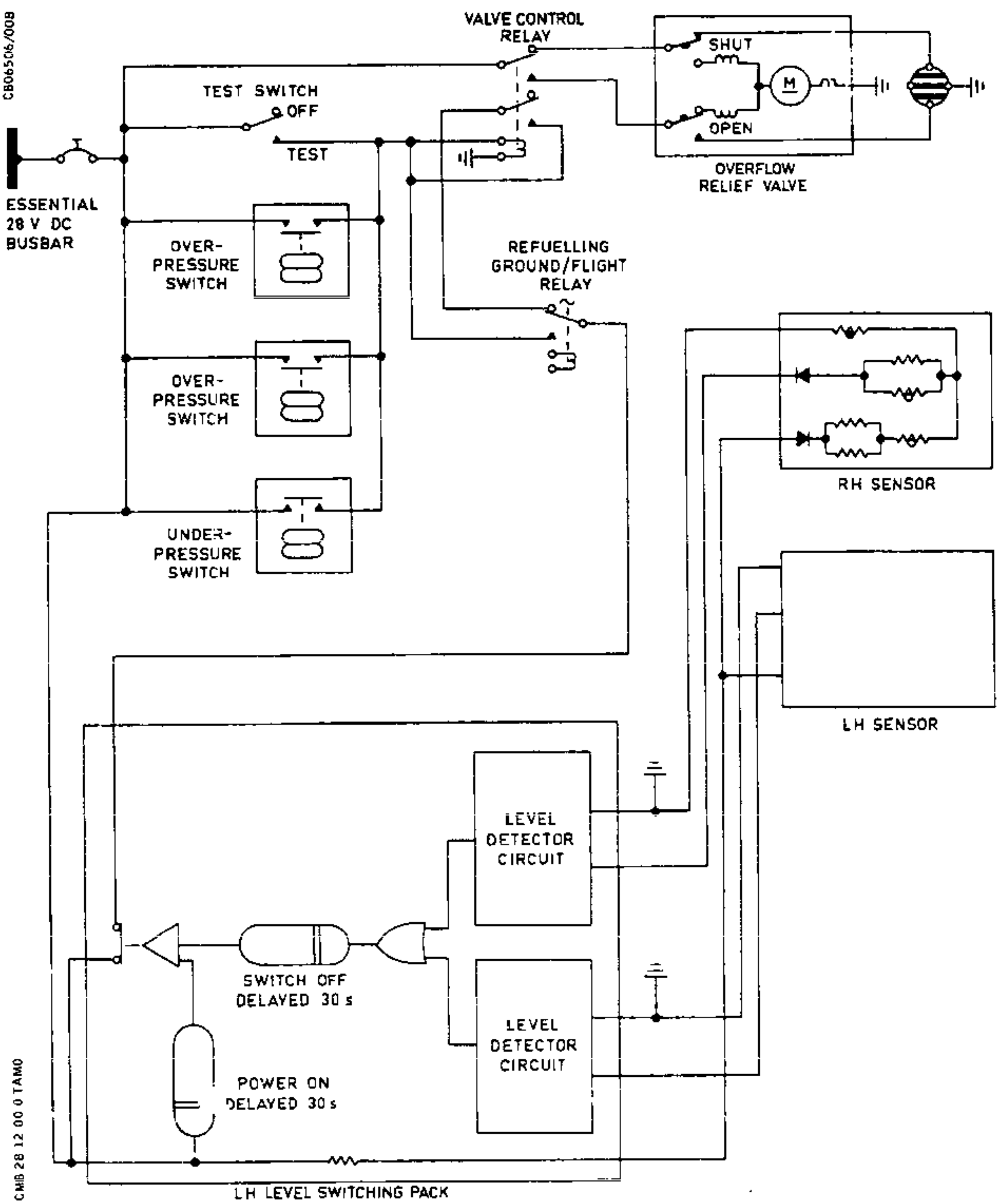


\- Tank Pressure Relief Valve - Control and Indication - Simplified Schematic
R Figure 017

R overpressure pressure switches and one underpressure pressure switch, all connected in parallel
R (Ref. Fig. 018). Further control is provided by fuel sensors in the scavenge tank. The magnetic indicator
R displays diagonal stripes when de-energized, OPEN when
R the valve is open and SHUT when the valve is closed.
R Operation of the valve is tested by pressing the ORV test switch.

If differential pressures within the system are outside the pre-set limits determined by the pressure switches, the valve is opened by closing the appropriate switch. On switching on, the level switching pack delays
R energizing the ORV circuits for 30 s to prevent opening the valve during the warm-up period. When refuelling, i.e., when the ground/flight relay is energized if fuel is detected by the scavenge tank sensor, the valve is
R opened and will remain open for approximately 30 s after the sensor signal ceases.

The vent shut-off valves, normally open, are operated



\- Overflow Relief Valve - Control and Indication - Simplified Schematic
Figure 018

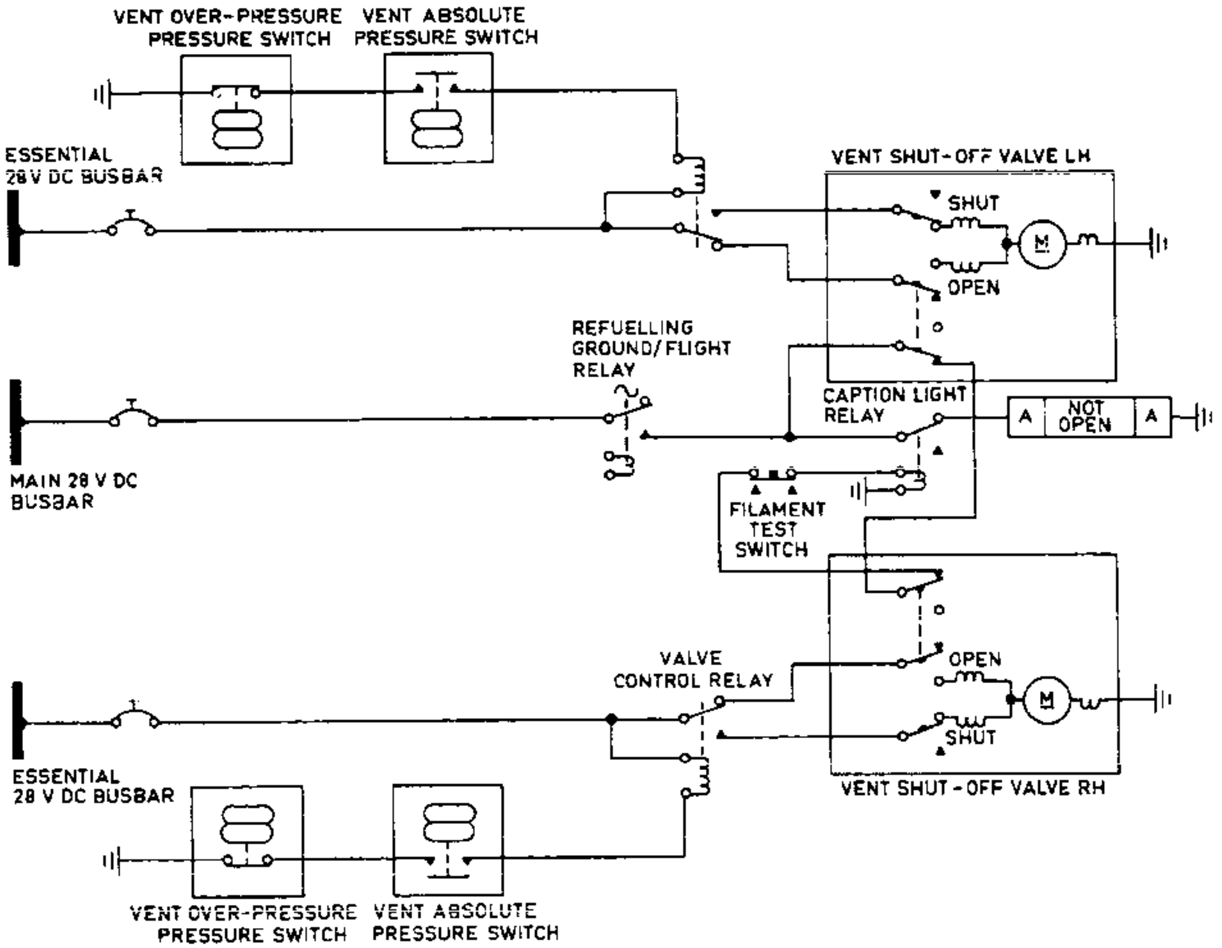
R

through a relay controlled by the associated vent over-pressure switch and vent absolute pressure switch (Ref. Fig. 019). The NOT OPEN caption is extinguished with both valves fully open, or illuminated amber if one or both valves are not fully open. In the normal condition, the caption light is tested on the ground simultaneously with the other caption lights, by depressing the FILAMENT TEST switch.

R 23. Electrical Power Supplies

SERVICE	BUSBAR	PANEL
Scavenge pump:		
Supply	No.4 main 200/115 V a.c.	14-216
Control and indication	'B' main 28 V d.c.	15-216
Overflow relief valve:		
Supply and indication	'A' essential 28 V d.c.	01-213
Vent shut-off valves:		
LH supply	'A' essential 28 V d.c.	01-213
RH supply	'B' essential 28 V d.c.	03-213
Refuel shut-off and vent valves indication	'A' main 28 V d.c.	15-215
Tank pressure relief valves:		
Refuel control and fail indication	'A' main 28 V d.c.	15-215
Trim pipe drain valves:		
Supply and indication	'A' main 28 V d.c.	15-215

CB06507/00B



CMB 28 12 00 0 UAM0

Vent Shut-off Valve - Control and Indication - Simplified Schematic
Figure 019

R

VENT AND PRESSURIZATION SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE GENERAL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4., 5., and 6.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

Where circuits are similar and incorporate identical components, i.e., LH and RH systems, all references to the associated components listed in Table 101 are given, e.g., 'Renew Drain Valve (13) or (14)'.

Electrical power should normally be on at the start of all tests except that for the scavenge tank pump (Ref. para.3.).

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.

Container, 3 fl oz (85 ml)	-
Air pressure/vacuum rig	-
Water drain tool	D925097000
Blank for ambient sense line	E925054000

B. Prepare

(1) Before trouble shooting the scavenge tank pump (Ref. para.3.), ensure that Circuit Breakers (1), (2) and (9), (Ref. Table 101) are set.

(2) Before trouble shooting the overflow relief valve (Ref. para.4.), ensure that Circuit Breaker (15) (Ref. Table 101) is set.

(3) Before trouble shooting the vent shut-off valve (Ref. para.5.), ensure that Circuit Breakers (27), (28) and (29) (Ref. Table 101) are set.

(4) Before trouble shooting the tank pressure relief valve (Ref. para.6.), ensure that Circuit Breaker (61) (Ref. Table 101) is set.

(5) Ensure that the fuel level in the tanks suits the requirements of the particular trouble shooting procedure.

(6) Except when preparing to trouble shoot the scavenge tank pump (Ref. para.3.), make available electrical ground power as detailed in 24-41-00.

(7) Display warning placards at the fuel management panel (3CM) and the refuelling control panel (1-194) to indicate that work is being carried out on the fuel system.

3. Trouble Shooting - Scavenge Tank Pump

A. NOTE: The scavenge pump will run for approximately 30 s when electrical power is first switched on, due to 'warming up' of sensor.

Prepare to trouble shoot (Ref. para.2.). Make available electrical ground power as detailed in 24-41-00. Check that the scavenge pump runs, and simultaneously the SCAVENGE PUMP indicator on panel 2-214 (3CM) displays ON for 30(±2) s. IF -

OK

NOT OK

1. Scavenge pump does not operate and indicator displays OFF when electrical power first switched on - Chart 101.
2. Pump indicator on but pump not heard to run, when electrical power first switched on - Chart 102.

```
B.******************************************
  *Check scavenge pump sensor operation as *
  *follows:-                               *
  *On panel 2-214 (3CM), ensure that TRIM  *
  *PIPE DRAIN switch is at SHUT and LH and *
  *RH indicators display SHUT.  Check tank *
  *3 fuel level is below 90 per cent.  Set *
  *TRIM PIPE DRAIN switch to "OPEN"; check *
  *that indicators display OPEN; check that*
  *mechanical indicators show open.  Set   *
  *tank 9 trim transfer pump to "ON";      *
  *check that SCAVENGE PUMP indicator dis- *
  *plays ON;  check that fuel is transferr-*
  *ing to tank 3.                          *
  *                                        *
  *NOTE:  During transfer, monitor A/C c.g.*
  *       Limitations (Ref. 28-25-00,      *
  *       Servicing - Defuelling Limita-   *
  *       tions                            *
  *                                        *
  *Set TRIM PIPE DRAIN switch to "SHUT";   *
  *check that associated indicators display*
  *SHUT within 2 s.  Set tank 9 trim       *
  *transfer pump to "OFF".  Check that     *
  *SCAVENGE INDICATOR displays OFF in not  *
  *less than 28 s from switching trim pipe *
  *drain switch shut.  IF-                 *
  ******************************************
                      |
                      |        --------------------------------
                      |       |1. Scavenge pump runs either    |
                   NOT OK-----|   intermittently or contin-    |
                              |   uously after test complete   |
                              |   with no other faults indic-  |
                              |   ated - Chart 103.            |
                              |2. Trim pipe drain valve fails  |
                              |   to OPEN/SHUT when control    |
                              |   switch operated -Chart 104.  |
                               --------------------------------
```

4. Trouble Shooting - Overflow Relief Valve (ORV)

```
A.******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At refuelling panel (1-194), check oper-*
  *ation of the ORV Test Switch (18) as    *
  *follows:-  Open panel (1-194) and set   *
  *refuel master control switch to "SET-UP"*
  *Check that ORV Indicator (19) displays  *
  *SHUT; check that ORV (17) mechanical    *
  *indicator shows 'C'.                    *
  *Hold ORV test switch at "TEST"; check   *
  *that -                                  *
  *(1) the indicator goes from SHUT to     *
  *    diagonal stripes then to OPEN within*
  *    2 s, and                            *
  *(2) the mechanical indicator on the ORV *
  *    shows 'O'.  IF -                    *
  ******************************************
             |        |
             |        |        --------------------------------
             |        |       |1. ORV opens when refuel panel  |
             OK       NOT OK--|   opened, and no fuel is dumped|
             |                |   - renew LH Level Switching   |
             |                |   Pack (22).                   |
             |                |2. Indicator (19) changes from  |
             |                |   SHUT to OPEN immediately the |
             |                |   test switch is operated -    |
             |                |   renew the ORV (17).          |
             |                |3. ORV operates but Indicator   |
             |                |   (19) does not verify. With   |
             |                |   valve held open remove free  |
             |                |   connector at ORV and check   |
             |                |   ORV pins B and D for contin- |
             |                |   uity.  If not OK, renew ORV  |
             |                |   (17): if OK, check associated|
             |                |   wiring for continuity before |
             |                |   renewing Indicator (19).     |
             |                |4. ORV does not open when test  |
             |                |   switch operated -  Chart 105.|
             |                |5. ORV does not close when test |
             |                |   switch released - Chart 106. |
             |                 --------------------------------
             |
```

B. With refuelling panel access door open, check operation of Scavenge Tank Sensors (20) and (21) as follows:-
Remove ORV Sensors (20) and (21) from scavenge tank, reconnect sensors to their electrical connectors.
Obtain a small container of clean fuel, with at least 1 in (25.4 mm) depth of fuel.
Immerse Sensor (20) in fuel. Check that ORV opens within 2 s. Remove sensor from fuel; check that ORV closes after 30(±2) s. Repeat check with Sensor (21). IF -

OK → C.

NOT OK →
1. ORV does not open when sensor immersed in fuel - Chart 107.
2. ORV does not close when sensor removed from fuel - Chart 108.

C. Check ORV over-pressure switches as follows:-
Set refuel master control switch to "OFF".
Close refuelling panel access door.
Connect suitable air pressure/vacuum test rig to ambient sense side of Over-pressure Pressure Switch (24).
Slowly apply suction to switch. Check that ORV opens at a negative pressure of between 2.8 and 3 psig (0.193 and 0.206 bar). Slowly release negative pressure. Check that ORV closes when negative pressure decreases to between 2.5 and 2 psig (0.172 and 0.137 bar). Repeat test but applied to Over-pressure Pressure Switch (25). IF -

```
               |        |           ---------------------------------
               |        |          |1. ORV does not open or close    |
               OK       NOT OK     |   when over-pressure pressure   |
               |                   |   switch operational conditions|
               |                   |   are simulated - Chart 109.    |
               |                    ---------------------------------
               |
D.*******************************************
  *Remove ORV Sensor (20) or (21) from      *
  *scavenge tank.  Immerse sensor in small  *
  *container of clean fuel. Repeat test C.,*
  *applied to either Over-pressure Pressure*
  *Switch (24) or (25). Check that ORV does*
  *not close when negative pressure         *
  *released.  Remove Sensor from fuel.      *
  *Check that ORV does not close until      *
  *30(±2) s after sensor removed from fuel.*
  *IF -                                     *
  *******************************************
               |        |
               |        |           ---------------------------------
               |        |          |1. ORV closes when negative      |
               OK       NOT OK-----|   pressure released, i.e., no   |
               |                   |   delay - Chart 110.            |
               |                    ---------------------------------
               |
E.*******************************************
  *Check ORV Under-pressure Pressure Switch*
  *(26) as follows:- Connect test rig to    *
  *ambient sense side of Under-pressure     *
  *Pressure Switch (26). Slowly apply       *
  *pressure. Check that ORV opens between   *
  *1.4 and 1.6 psig (0.096 and 0.110 bar).  *
  *Slowly release pressure. Check that ORV  *
  *closes when pressure drops to 0.70 psig  *
  *(0.048 bar).  IF -                       *
  *******************************************
                        |
                        |           ---------------------------------
                        |          |1. ORV does not open or close    |
                        |          |   when under-pressure pressure  |
                        NOT OK-----|   switch operational conditions|
                                   |   are simulated - Chart 111.    |
                                    ---------------------------------
```

5. Trouble Shooting - Vent Shut-off Valve

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At the refuelling panel (1-194) check   *
  *the vent valve NOT OPEN caption as      *
  *follows:-                               *
  *Ensure that refuel master control switch*
  *is at SET UP.                           *
  *Check that NOT OPEN caption is not      *
  *illuminated. Press the filament test    *
  *switch; check that NOT OPEN caption is  *
  *illuminated. Release test switch; check *
  *that NOT OPEN caption is extinguished.  *
  *IF -                                    *
  ******************************************
              |        |
              |        |    --------------------------------
              |        |   |1. Caption is illuminated before|
             OK       NOT OK-----|   test switch is operated -  |
              |            |   Chart 112.                   |
              |            |2. Caption is not illuminated   |
              |            |   when test switch is operated |
              |            |   - renew filaments in         |
              |            |   Indicator (31).              |
              |            |   Fault not cleared - Chart 113|
              |            |3. Caption is not extinguished  |
              |            |   when test switch is          |
              |            |   released - Chart 114.        |
              |             --------------------------------
              |
B.*******************************************
  *Check vent valve Absolute Pressure      *
  *Switch (37) or (38) as follows:-        *
  *Connect air pressure/vacuum rig to      *
  *pressure switch.  Slowly reduce air     *
  *pressure at switch; check that Vent     *
  *Shut-off Valve (35) or (36) closes when *
  *absolute pressure is between 2.65 and   *
  *2.05 psia (0.183 and 0.141 bar). Slowly *
  *increase pressure and check that vent   *
  *shut-off valve opens when absolute      *
  *pressure is between 2.05 and 2.65 psia  *
  *(0.141 and 0.183 bar).  IF -            *
  ******************************************
              |        |
             OK       NOT OK
```

```
             |          |
             |          |         |1. Vent shut-off valve does not |
             OK         NOT OK----|   close/open during absolute   |
             |                    |   pressure switch test -       |
             |                    |   Chart 115.                   |
             |
             |
C.*******************************************
  *Check vent valve Over-pressure Pressure *
  *Switch (39) or (40) as follows:-        *
  *Disconnect electrical connector from    *
  *Absolute Pressure Switch (37) or (38).  *
  *Fit a shorting link to free connector   *
  *pins A and B.  Ensure that the Vent     *
  *Shut-off Valve (35) or (36) closes.     *
  *Connect air pressure/vacuum rig to      *
  *ambient sense side of switch (39) or    *
  *(40).  Slowly reduce air pressure at    *
  *switch; check that vent shut-off valve  *
  *opens at a negative pressure of between *
  *3.73 and 3.75 psig, (0.257 and 0.258    *
  *bar).  Slowly release negative pressure *
  *check that vent shut-off valve closes   *
  *when negative pressure increases to     *
  *2.75 psig (0.189 bar) minimum.          *
  *Remove link from free connector of      *
  *Over-pressure Pressure Switch (37) or   *
  *(38) and reconnect the connector to the *
  *switch.  IF -                           *
  *******************************************
                        |
                        |
                        |         |1. Vent shut-off valve does not |
                        NOT OK----|   open/close - check associated|
                                  |   wiring before renewing Over- |
                                  |   pressure Pressure Switch (39)|
                                  |   or (40).                     |
```

6. Trouble Shooting - Tank Pressure Relief Valve (TPRV) Indication

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At refuelling panel (1-194) check TPRVs *
  *as follows:-                            *
  *Ensure that fuel level in tanks 5, 6, 7,*
  *8, 9 and 10 is below 90 per cent full.  *
  *Ensure that TPRV selector switch is    *
  *turned fully counter-clockwise to NORMAL*
  *Ensure that refuel master control switch*
  *is at SET UP.                           *
  *Check that PRV caption is illuminated.  *
  *Press the TPRV EARTH TEST switch, and   *
  *check that PRV caption is extinguished. *
  *Release test switch, check that PRV     *
  *caption is illuminated.  IF -           *
  ******************************************
                    |
                    |                ---------------------------------
                    |               |1. PRV caption is not           |
                 NOT OK-----|   illuminated with refuel      |
                            |   master control switch at SET |
                            |   UP. Test the caption fila-   |
                            |   ments.  IF OK - Chart 116.   |
                            |2. PRV caption is not exting-   |
                            |   uished when TPRV EARTH TEST  |
                            |   switch is pressed - Chart 117|
                             ---------------------------------
```

SCAVENGE PUMP DOES NOT OPERATE AND INDICATOR DISPLAYS 'OFF' WHEN ELECTRICAL POWER FIRST SWITCHED ON.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

Switch off electrical ground power --- Interchange the RH and LH Level Switching Packs (6) and (22). Reinstate electrical ground power. Is fault cleared?

- YES - Renew original RH Level Switching pack (6).
- NO - Check for 28 V d.c. at terminal A5 of test module UT1886 on panel 24-123 (RH fuel contactor box).
  - YES - *Renew relay (4). Is fault cleared?
    - NO - *Renew Sensor (7).
  - NO - Check for 28 V d.c. output from CB (2).
    - YES - Rectify O/C in wiring between CB (2) and panel 24-123.
    - NO - Renew CB (2).

Chart 101

PUMP INDICATOR ON BUT PUMP NOT HEARD TO RUN WHEN ELECTRICAL POWER FIRST SWITCHED ON.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------------      -----------------              -----------------
|Repeat test (Ref.|    |Disconnect       |            |Renew Pump (5).  |
|para.3.A.). Leave|----|electrical       |-YES---------------------------
|electrical power |    |connector at Pump|
|on.              |    |(5). Check for   |
 -----------------     |200/115 V a.c.   |
                       |3-ph. input at   |
                       |free connector.  |
                        -----------------
                               |
                               NO
                               |
                        -----------------              -----------------
                       |Check for 200/   |-YES-|*Renew Relay (4).|
                       |115 V a.c. 3-ph. |             -----------------
                       |output from CB   |
                       |(1).             |
                        -----------------
                               |
                               NO
                               |
                        -----------------
                       |Renew CB (1).    |
                        -----------------
```

Chart 102

SCAVENGE PUMP RUNS EITHER INTERMITTENTLY OR CONTINOUSLY AFTER TEST COMPLETE, WITH NO OTHER FAULTS INDICATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

<u>NOTE</u>: Before renewal of components (*), check the associated run of wiring for continuity.

Repeat test (Ref. para.3.B.). Leave electrical power on.

→ Disconnect electrical connector at Sensor (7). Check that pump stops running.

- YES → Renew NRV (8).
- NO → Interchange the RH and LH Level Switching Packs (6) and (22). Is fault cleared?
  - YES → Renew original RH Level Switching Pack (6).
  - NO → Renew Relay (4).

Chart 103

TRIM PIPE DRAIN VALVE FAILS TO 'OPEN/SHUT', WHEN CONTROL SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 ----------     -----------------      ----------      ----------
|Repeat    |   |Disconnect elec- |    |Check for |    |Renew CB  |
|test (Ref.|---|trical connector |-NO-|28 V d.c. |-NO-|(9).      |
|para.3.B.)|   |at Drain Valve   |    |output at |     ----------
|Leave     |   |(13) or (14).    |    |CB (9).   |
|electrical|   |With control     |     ----------
|power on. |   |switch at OPEN,  |         |
 ----------    |check free conn- |        YES
               |ector at pin B, or|        |
               |with control     |     ----------
               |switch at SHUT,  |    |*Renew    |
               |check free conn- |    |Control   |
               |ector at pin C,  |    |Switch    |
               |for 28 V d.c.    |    |(12).     |
               |output.          |     ----------
                -----------------
                       |
                      YES
                       |
                 ---------------------------------      ----------
                |With drain valve at SHUT, check  |    |Renew     |
                |for continuity at valve fixed    |-NO-|Drain     |
                |connector between pins B and A;  |    |Valve (13)|
                |if drain valve OPEN, check be-   |    |or (14).  |
                |tween pins C and A.              |     ----------
                 ---------------------------------
                       |
                      YES
                       |
 ---------       ---------------------------------      ----------
|Renew In-|     |With drain valve SHUT, check for |    |Renew     |
|dicator  |-YES-|continuity at valve fixed con-   |-NO-|Drain     |
|(10) or  |     |nector between pins C and E; if  |    |Valve (13)|
|(11).    |     |drain valve OPEN, check between  |    |or (14).  |
 ---------      |pins B and D.                    |     ----------
                 ---------------------------------
```

Chart 104

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```
*******************************                ---------------------------------
*ORV DOES NOT OPEN WHEN TEST  *               |GROUND EQUIPMENT REQUIRED       |
*SWITCH OPERATED.             *               |--------------------------------|
*******************************               |DESCRIPTION           PART NO.  |
                                              |--------------------------------|
                                              |GROUND POWER SUPPLY   -         |
                                              |MULTIMETER            -         |
                                               ---------------------------------
```

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------------          -----------------          -----------------
|Repeat test (Ref.|        |Disconnect elec- |        |Renew Valve (17).|
|para.4.A.). Leave|--------|trical connector |-YES-------------------------
|electrical power |        |at Valve (17).   |
|on.              |        |With test switch |
 -----------------         |held on, check   |
                           |free connector at|
                           |pin B for 28 V   |
                           |d.c. output.     |
                            -----------------
                                    |
                                    NO
                                    |
                            -----------------          -----------------
                           |Check for 28 V   |--NO-|*Renew CB (15).   |
                           |d.c. output at   |        -----------------
                           |CB (15).         |
                            -----------------
                                    |
                                   YES
                                    |
                            -----------------          -----------------
                           |With test switch |--NO-|*Renew Test       |
                           |held on, check   |      |Switch (18).      |
                           |for 28 V d.c. at |        -----------------
                           |terminal C16 of  |
                           |test module      |
                           |UT1852 on panel  |
                           |18-123 (RH fuel  |
                           |relay box).      |
                            -----------------
                                    |
                                   YES
                                    |
                            -----------------
                           |Renew Relay (16).|
                            -----------------
```

Chart 105

```
********************************     ---------------------------------
*ORV DOES NOT CLOSE WHEN TEST *     |GROUND EQUIPMENT REQUIRED        |
*SWITCH RELEASED.             *     |---------------------------------|
********************************     |DESCRIPTION          PART NO.   |
                                     |---------------------------------|
                                     |GROUND POWER SUPPLY   -          |
                                     |MULTIMETER            -          |
                                      ---------------------------------

 -----------------       -----------------       -----------------
|Repeat test (Ref.|-----|Disconnect elect-|-YES-|Renew ORV (17).  |
|para.4.A.).      |     |rical connector  |      -----------------
|Release test     |     |from ORV (17) and|
|switch and leave |     |check for 28 V   |
|electrical power |     |d.c. input at pin|
|on.              |     |C of the free    |
 -----------------      |connector.       |
                         -----------------
                                 |
                                 NO
                                 |
                         -----------------       -----------------
                        |Check for 28 V   |--NO-|Renew Relay (16).|
                        |d.c. at terminal |      -----------------
                        |C16 of test      |
                        |module UT1852 on |
                        |panel 18-123 (RH |
                        |fuel relay box). |
                         -----------------
                                 |
                                YES
                                 |
                         -----------------
                        |Renew Test Switch|
                        |(18).            |
                         -----------------
```

Chart 106

```
********************************
*ORV DOES NOT OPEN WHEN SENSOR*
*IMMERSED IN FUEL.            *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------    -------------      -------------
|Repeat test|   |Does ORV fail|    |*Renew Sensor|
|(Ref. para.|---|to open on   |--NO-|(20) or (21) |
|4.B.).     |   |test of both |    |that failed  |
|Leave elec-|   |sensors?     |    |to open ORV. |
|trical     |    -------------      -------------
|power on.  |          |
 -----------          YES
                        |
                        |
             -----------------     --------------
            |Interchange the  |   |Renew original|
            |LH and RH Level  |-YES-|LH level      |
            |Switching Packs  |   |Switching Pack|
            |(22) and (6).    |   |(22).         |
            |Repeat test. Is  |    --------------
            |fault cleared?   |
             -----------------
                   NO
                   |
             -----------------     -------------       ---------
            |Check for elec-  |   |Is refuelling|     |*Renew   |
            |trical supply at |--NO-|panel illum- |-YES-|Ground   |
            |terminal C16 of  |   |inated, i.e.,|     |Flight   |
            |test module      |   |is floodlight|     |Relay    |
            |UT1852 on panel  |   |on and are   |     |(23).    |
            |18-123 (RH fuel  |   |instruments  |      ---------
            |relay box).      |   |integrally   |
             -----------------    |lit?         |
                   |               -------------
                  YES                    |
                   |                     NO
             -------------------         |
            |Retest and trouble |    --------------------------
            |shoot using test   |   |Trouble shoot the refuel- |
            |switch (Ref. Chart |   |ling panel microswitch    |
            |105).              |   |circuit (Ref.28-24-00).   |
             -------------------     --------------------------
```

Chart 107

ORV DOES NOT CLOSE WHEN SENSOR REMOVED FROM FUEL.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
SMALL CONTAINER, FOR FUEL	-

Repeat test (Ref. para.4.B.). Leave electrical power on.

Disconnect electrical connector from Sensor (20) or (21). Check that ORV closes after 30(±2) s.

- YES: Renew Sensor (20) or (21).
- NO: Renew LH Level Switching Pack (22).

Chart 108

ORV DOES NOT OPEN OR CLOSE WHEN OVER-PRESSURE PRESSURE SWITCH OPERATIONAL CONDITIONS ARE SIMULATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Disconnect electrical connector at Pressure Switch (24) or (25). Check free connector at pin A for 28 V d.c. output.

- NO → Check for O/C in associated wiring
- (left branch) → Repeat test (Ref. para.4.C.). Leave electrical power on.
- YES ↓

Fit shorting link to free connector pins A and B. Check that ORV opens. Remove link; check that ORV closes.

- YES → Renew Over-pressure Pressure Switch (24) or (25).
- NO ↓

Retest and trouble shoot, using test switch (Ref. Charts 105 and 106).

Chart 109

```
*******************************
*ORV CLOSES WHEN NEGATIVE     *
*PRESSURE RELEASED, I.E., NO  *
*DELAY.                       *
*******************************
```

GROUND EQUIPMENT REQUIRED

DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
SMALL CONTAINER FOR FUEL	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------------         ----------------        ---------------
|Repeat test (Ref. |      |Remove Relay (16)|     |Renew Relay    |
|para.4.D.).  Leave|-----|from panel 18-123|-YES-|(16).          |
|electrical power  |      |and check for    |      ---------------
|on and sensor     |      |electrical supply|
|immersed in fuel. |      |at contact B2 of |
 -----------------        |relay socket.    |
                           ----------------
                                  |
                                  NO
                                  |
                           -----------------
                          |*Renew Relay (23).|
                           -----------------
```

Chart 110

```
********************************
*ORV DOES NOT OPEN OR CLOSE    *
*WHEN UNDER-PRESSURE PRESSURE *
*SWITCH OPERATIONAL CONDITIONS*
*ARE SIMULATED.               *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 ----------------      ----------------         ----------------
|Repeat test (Ref.|   |Disconnect elec- |       |Check for O/C in |
|para.4.E.). Leave|---|trical connector |--NO-- |associated wiring|
|electrical power |   |at Pressure      |        ----------------
|on.              |   |Switch (26).     |
 ----------------     |Check free con-  |
                      |nector at pin A  |
                      |for 28 V d.c.    |
                      |output.          |
                       ----------------
                             |
                            YES
                             |
                       ----------------         ----------------
                      |Fit shorting link|       |Renew Under-     |
                      |to free connector|-YES-  |pressure Pressure|
                      |pins A and B.    |       |Switch (26).     |
                      |Check that ORV   |        ----------------
                      |opens. Remove    |
                      |link; check that |
                      |ORV closes.      |
                       ----------------
                             |
                             NO
                             |
                       ----------------
                      |*Renew Control   |
                      |Relay (16).      |
                       ----------------
```

Chart 111

CAPTION IS ILLUMINATED BEFORE TEST SWITCH IS OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

Repeat test (Ref. para. 5.A.). Leave electrical power on.
---- Check that mechanical indicators on Vent Shut-off Valves (35) and (36) show open.

Check that mechanical indicators on Vent Shut-off Valves (35) and (36) show open.
- NO → Is vent shut-off valve partially closed?
  - YES → Renew Vent Shut-off Valve (35) or (36).
  - NO → Is vent shut-off valve fully closed?
    - YES → Disconnect electrical connector at Vent Shut-off Valve (35) or (36). Check for 28 V d.c. at pin C of of free connector.
      - NO → Renew Vent Shut-off Valve (35) or (36).
      - YES → (continued on Sheet 2)
- YES → Check for 28 V d.c. at Test Switch (32), terminal 3.
  - NO → Disconnect electrical connector at Vent Shut-off Valves (35) and (36). Check for continuity through pins E and and D of each vent shut-off valve.
    - NO → (continued on Sheet 2)
  - YES → Check for continuity through Test Switch (32), terminals 3 and 4.
    - NO → *Renew Test Switch (32).
    - YES → (continued on Sheet 2)

Continued on Sheet 2

Chart 112 (Sheet 1 of 2)

Continued from Sheet 1

NO

Renew Vent Shut-off Valve (35) or (36).

YES

*Renew Indicator Control Relay (30).

YES

Disconnect electrical connector at Absolute Pressure Switch (37) or (38). Does vent shut-off valve open?

NO → *Renew Control Relay (33) or (34).

YES → Renew Absolute Pressure Switch (37) or (38).

Chart 112 (Sheet 2 of 2)

```
********************************
*CAPTION IS NOT ILLUMINATED   *
*WHEN TEST SWITCH IS OPERATED.*
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------    ------------      -------------      -----------
|Repeat test|  |Check for 28|    |Renew CB (29)|    |*Renew     |
|(Ref. para.|--|V d.c. out- |-NO--------------     |Indicator  |
|5.A). Leave|  |put at CB   |                      |(31).      |
|electrical |  |(29).       |     -------------      -----------
|power on.  |   ------------     |Release fila-|          |
 -----------         |           |ment Test    |         YES
                    YES          |Switch (32). |          |
                     |           |Remove Relay |      -----------
                ------------     |(30) and     |     |Check for  |
               |Press and   |-NO-|check for 28 |-YES-|continuity |
               |hold fila-  |    |V d.c. at pin|     |between    |
               |ment Test   |    |A2 of relay  |     |pins A2 and|
               |Switch (32).|    |socket.      |     |A3 of Relay|
               |Check for   |     -------------      |(30).      |
               |0 V at term-|          |              -----------
               |inal A15 of |          |                  |
               |test module |         NO                 NO
               |UT1854 on   |          |                  |
               |panel 18-123|     -------------      -----------
               |(RH fuel    |    |Is refuelling|    |Renew Relay|
               |relay box). |    |panel illum- |    |(30).      |
               |Is voltage  |    |inated, i.e.,|     -----------
               |present?    |    |is floodlight|
                ------------     |on and are   |     -----------
                     |           |instruments  |-YES-|*Renew     |
                    YES          |integrally   |     |Ground/    |
                     |           |lit?         |     |Flight     |
                ------------      -------------      |Relay (23).|
               |*Renew Test |          |              -----------
               |Switch (32).|         NO
                ------------           |
            ----------------------------------------
           |Trouble shoot the refuelling panel      |
           |microswitch circuit (Ref. 28-24-00)     |
            ----------------------------------------
```

Chart 113

```
********************************
*CAPTION IS NOT EXTINGUISHED  *
*WHEN TEST SWITCH IS RELEASED.*
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------------      -----------------            -----------------
|Repeat test (Ref.|    |Check for 28 V   |          |*Renew Indicator |
|para.5.A.). Leave|----|d.c. at RH fuel  |-YES-     |Control Relay    |
|electrical power |    |relay box        |          |(30).            |
|on.              |    |(18-123), test   |           -----------------
 -----------------     |module UT1854,   |
                       |terminal A15.    |
                        -----------------
                               |
                               NO
                               |
                        -----------------
                       |*Renew Test      |
                       |Switch (32).     |
                        -----------------
```

Chart 114

```
********************************          --------------------------------
*VENT SHUT-OFF VALVE DOES NOT *          |GROUND EQUIPMENT REQUIRED       |
*CLOSE/OPEN DURING ABSOLUTE   *          |--------------------------------|
*PRESSURE SWITCH TEST.        *          |DESCRIPTION            PART NO. |
********************************          |--------------------------------|
                                          |GROUND POWER SUPPLY    -        |
                                          |MULTIMETER             -        |
                                           --------------------------------
```

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------      ---------------        -----------
|Repeat test|    |Disconnect     |      |Renew      |
|(Ref. para.|---|electrical con-|-YES-|Pressure   |
|5.B.).     |    |nector from    |      |Switch (37)|
|Leave      |    |Pressure Switch|      |or (38).   |
|electrical |    |(37) or (38).  |       -----------
|power on.  |    |Fit shorting   |
 -----------     |link to free   |
                 |connector pins |
                 |A and B. Check |
                 |that valve     |
                 |closes. Remove |
                 |link; check    |
                 |that valve     |
                 |opens.         |
                  ---------------
                        |
                        NO
                        |
 -----------       ------------       -----------       -----------
|Check CB   |     |Check for 28|     |Connect pin|     |Check Vent |
|(28) or    |-NO-|V d.c. at   |-YES-|A of free  |-YES-|Pressure   |
|(29) for 28|     |pin A of    |     |connector  |     |Over-press-|
|V d.c. out-|     |free conn-  |     |to earth.  |     |ure Switch |
|put.       |     |ector.      |     |Check that |     |(39) or    |
 -----------       ------------      |valve      |     |(40). (Ref.|
    |   |          -------------     |closes.    |     |para.5.C.).|
   YES  NO-------|*Renew CB    |     |Disconnect |      -----------
    |            |(28) or (29).|     |earth;     |
 --------------   -------------      |check that |
|*Renew Control|                     |valve      |
|Relay (33) or |                     |opens.     |
|(34). Is fault|                      -----------
|cleared?      |                          |
 --------------                           NO
      | NO                                |
```

Continued on Sheet 2

Chart 115 (Sheet 1 of 2)

```
     NO        Continued from Sheet 1       NO
     |                                      |
 -----------    -----------    --------------           ------------
|*Renew Vent|  |*Renew     |  |Disconnect    |         |With valve  |
|Shut-off   |  |Control    |  |electrical    |         |open, check |
|Valve (35) |  |Relay (33) |-NO-|connector from|-YES-|for contin- |
|or (36).   |  |or (34).   |  |Vent Shut-off |         |uity through|
 -----------    -----------   |Valve (35) or |         |valve fixed |
                              |(36).  With   |         |connector   |
                              |switching     |         |pins C and A|
                              |simulated to  |         |or, with    |
                              |open valve,   |         |valve closed|
                              |check free    |         |check for   |
                              |connector pin |         |continuity  |
                              |B for 28 V    |         |through pins|
                              |d.c. or, with |         |B and A.    |
                              |switching     |          ------------
                              |simulated to  |               |
                              |close valve,  |               NO
                              |check for 28  |               |
                              |V d.c. at pin |          ------------
                              |C.            |         |Renew Vent  |
                               --------------          |Shut-off    |
                                                       |Valve (35)  |
                                                       |or (36).    |
                                                        ------------
```

Chart 115 (Sheet 2 of 2)

PRV CAPTION IS NOT ILLUMINATED WITH REFUEL MASTER CONTROL SWITCH AT 'SET UP'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

Repeat test (Ref. para. 6.A.). Leave electrical power on.

R Disconnect connector at Selector Switch (63) and check for 28 V d.c. input at terminal A on free connector.

- YES → Reconnect connector to Selector Switch (63). Rotate TPRV selector clockwise to each of the 16 test positions Check that PRV caption is illuminated in each position.
  - NO → At the failed position, gain access to the associated Valve (45) to (60). Disconnect electrical cables from valve and link together. Check that PRV caption is illuminated.
    - YES → Renew associated Valve (45) to (60).
    - NO ↓
- NO → Check CB (61) for 28 V d.c. output.
  - NO → *Renew CB (61).
  - YES → Is refuelling panel illuminated, i.e., is floodlight on and are instruments integrally lit?.
    - NO → Trouble shoot the refuelling panel microswitch circuit Ref. 28-24-00).
    - YES ↓

Continued on Sheet 2

Chart 116 (Sheet 1 of 2)

Continued from Sheet 1

YES

*Renew Ground Flight Relay (23).

NO

*Renew PRV Indicator (64). Is fault cleared?

NO

*Renew Selector Switch (63).

Chart 116 (Sheet 2 of 2)

```
********************************
*PRV CAPTION IS NOT            *
*EXTINGUISHED WHEN 'TPRV EARTH*
*TEST' SWITCH IS PRESSED.      *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------------       -----------------         -----------------
|Repeat test (Ref.|     |At refuelling    |       |Isolate Earth    |
|para.6.A.). Leave|-----|control panel    |-YES-|Test Switch (65) |
|electrical power |     |(1-194), hold    |       |from circuit.    |
|on.              |     |Earth Test Switch|       |Using multimeter |
 -----------------      |(65) in. Check   |       |and TPRV selector|
                        |for O/C between  |       |switch at all    |
                        |terminals 3 and 4|       |positions, check |
                         -----------------        |for stray earth  |
                                 |                |fault. Rectify   |
                                 NO               |as required.     |
                                 |                |Reconnect earth  |
                         -----------------        |test switch into |
                        |*Renew Earth Test|       |circuit.         |
                        |Switch (65).     |        -----------------
                         -----------------
```

Chart 117

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1) Circuit breaker 200/ 115 V	-	14-216	Q491	Map ref.E4	24-50-00 R/I	28-12-01
(2) Circuit breaker 28 V	-	15-216	Q493	Map ref.C6	24-50-00 R/I	28-12-01
(3) Scavenge pump indicator	-	2-214	Q494	3CM station fuel management panel	28-00-00 R/I	28-12-01
(4) Scavenge pump control relay	-	24-123	Q498	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-12-01
(5) Scavenge pump	153 BB	-	Q500	Rear fuselage, underfloor, F 74	28-12-59 R/I	28-12-01
(6) Level switching pack, RH	-	2-216	Q1351	Flight compartment upper racking	28-42-51 R/I	28-12-01
(7) Scavenge pump tank sensor	153 BB	-	Q502	Rear fuselage underfloor, F 74	28-12-54 R/I	28-12-01
(8) Non-return valve (NRV)	198 DB	-	-	Beneath No.3 tank in under-wing fillet	28-12-15 R/I	-
(9) Circuit breaker 28 V	-	15-215	Q701	Map ref.G22	24-50-00 R/I	28-12-71
(10) Trim pipe drain valve indicator, LH	-	2-214	Q703	3CM station fuel management panel	28-00-00 R/I	28-12-71

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(11) Trim pipe drain valve indicator, RH	-	2-214	Q706	3CM station fuel management panel	28-00-00 R/I	28-12-71
(12) Trim pipe drain valve control switch	-	2-214	Q702	3CM station fuel management panel	28-00-00 R/I	28-12-71
(13) Trim pipe drain valve, LH	153 EB	-	Q704	Rear fuse-lage, underfloor, F 77-78	28-12-58 R/I	28-12-71
(14) Trim pipe drain valve, RH	154 CB	-	Q705	Rear fuse-lage, underfloor, F 75-76	28-12-58 R/I	28-12-71
(15) Circuit breaker 28 V	-	1-213	Q721	Map ref.K15	24-50-00 R/I	28-12-05
(16) Overflow relief valve control relay	-	18-123	Q734	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-12-05
(17) Overflow relief valve (ORV)	153 CB 154 CB	- -	Q736	Rear fuse-lage, underfloor	28-12-52 R/I	28-12-05
(18) ORV test switch	-	1-194	Q726	Refuelling control panel	28-00-00 R/I	28-12-05
(19) ORV indicator	-	1-194	Q724	Refuelling control panel	28-00-00 R/I	28-12-05
(20) ORV scavenge tank sensor	153 BB	-	Q739	Rear fuse-lage, underfloor	28-12-54 R/I	28-12-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(21) ORV scavenge tank sensor	153 BB	-	Q740	Rear fuselage, underfloor	28-12-54 R/I	28-12-05
(22) Level switching pack, LH	-	10-216	Q1350	RH flight compartment racking	28-42-51 R/I	28-12-05
(23) Ground/ flight relay	-	18-123	Q599	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-12-05
(24) Vent over-pressure pressure switch	292 GT	-	Q727	RH wing upper fillet	28-12-33 R/I	28-12-05
(25) Vent over-pressure pressure switch	153 CB	-	Q741	Rear fuselage under-floor	28-12-33 R/I	28-12-05
(26) Vent under-pressure pressure switch	153 CB	-	Q728	Rear fuselage under-floor	28-12-55 R/I	28-12-05
(27) Circuit breaker 28 V	-	15-215	Q511	Map ref.E19	24-50-00 R/I	28-24-02
(28) Circuit breaker 28 V	-	01-213	Q722	Map ref.K16	24-50-00 R/I	28-12-06
(29) Circuit breaker 28 V	-	03-213	Q723	Map ref.D7	24-50-00 R/I	28-12-06
(30) Indicator control relay	-	18-123	Q735	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-12-06
(31) Vent valve indicator	-	1-194	Q725	Refuelling control panel	28-00-00 R/I	28-12-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(32) Filament test switch	-	1-194	Q653	Refuelling control panel	28-00-00 R/I	28-24-01
(33) Vent valve control relay	-	15-123	Q743	LH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-12-06
(34) Vent valve control relay	-	18-123	Q742	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-12-06
(35) Vent shut-off valve, LH	Via tail wheel bay	-313	Q738	Rear fuse-lage, aft of tank 11	28-12-51 R/I	28-12-06
(36) Vent shut-off valve, RH	Via tail wheel bay	-314	Q737	Rear fuse-lage, aft of tank 11	28-12-51 R/I	28-12-06
(37) Vent absolute pressure switch, LH	Via tail wheel bay	-313	Q732	Rear fuse-lage, aft of tank 11	28-12-57 R/I	28-12-06
(38) Vent absolute pressure switch, RH	Via tail wheel bay	-314	Q731	Rear fuse-lage, aft of tank 11	28-12-57 R/I	28-12-06
(39) Vent over-pressure pressure switch, LH	Via tail wheel bay	-313	Q733	Rear fuse-lage, aft of tank 11	28-12-56 R/I	28-12-06
(40) Vent over-pressure pressure switch, RH	Via tail wheel bay	-314	Q730	Rear fuse-lage, aft of tank 11	28-12-56 R/I	28-12-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(41) Pressure control valve	Via tail wheel bay	-314	-	Rear fuselage, aft of tank 11	28-12-51 R/I	-
(42) Ambient sense line drain valve	153 BB	-	-	Rear fuselage, RH of scavenge tank	28-12-62 R/I	-
(43) Inward relief vent valve, LH	291 AT	-	-	Fwd. of tank 9, wing cell	28-12-31 R/I	-
(44) Inward relief vent valve, RH	292 AT	-	-	Fwd. of tank 9, wing cell	28-12-31 R/I	-
(45) Tank pressure relief valve	524 AT	-	Q643	In tank 5	28-12-11 R/I	28-12-03
(46) Tank pressure relief valve	524 DT	-	Q644	In tank 5	28-12-11 R/I	28-12-03
(47) Tank pressure relief valve	525 UT	-	Q647	In tank 5A	28-12-11 R/I	28-12-03
(48) Tank pressure relief valve	525 KT	-	Q646	In tank 6	28-12-11 R/I	28-12-03
(49) Tank pressure relief valve	525 LT	-	Q645	In tank 6	28-12-11 R/I	28-12-03
(50) Tank pressure relief valve	625 KT	-	Q651	In tank 7	28-12-11 R/I	28-12-03
(51) Tank pressure relief valve	625 LT	-	Q652	In tank 7	28-12-11 R/I	28-12-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(52) Tank pressure relief valve	625 UT	-	Q648	In tank 7A	28-12-11 R/I	28-12-03
(53) Tank pressure relief valve	523 CT	-	Q649	In tank 8	28-12-11 R/I	28-12-03
(54) Tank pressure relief valve	623 FT	-	Q650	In tank 8	28-12-11 R/I	28-12-03
(55) Tank pressure relief valve	521 AT	-	Q637	In tank 9	28-12-11 R/I	28-12-03
(56) Tank pressure relief valve	621 AT	-	Q638	In tank 9	28-12-11 R/I	28-12-03
(57) Tank pressure relief valve	621 BT	-	Q639	In tank 9	28-12-11 R/I	28-12-03
(58) Tank pressure relief valve	522 CT	-	Q640	In tank 10	28-12-11 R/I	28-12-03
(59) Tank pressure relief valve	522 BT	-	Q641	In tank 10	28-12-11 R/I	28-12-03
(60) Tank pressure relief valve	622 BT	-	Q642	In tank 10	28-12-11 R/I	28-12-03
(61) Circuit breaker 28 V	-	15-215	Q513	Map ref.E20	24-50-00 R/I	28-12-03
(62) Refuel control switch	-	1-194	Q549	Refuelling control panel	28-00-00 R/I	
(63) TPRV selector	-	1-194	Q576	Refuelling control	28-24-62 R/I	28-12-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
switch				panel		
(64) Pressure relief valve (PRV) indicator	-	1-194	Q540	Refuelling control panel	28-00-00 R/I	28-12-03
(65) Earth test switch (TPRV)	-	1-194	Q547	Refuelling control panel	28-00-00 R/I	28-12-03

Component Identification
Table 101

VENT AND PRESSURIZATION SYSTEM - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

LIGHT REACHING THE DETECTOR UNIT OF THE FUEL VENT EXPLOSION SUPPRESSION SYSTEM COULD INITIATE OPERATION OF THE SYSTEM. THEREFORE, BEFORE REMOVING COMPONENTS OR DISCONNECTING PIPING OF THE FUEL VENT SYSTEM, ELECTRICALLY ISOLATE THE FUEL VENT EXPLOSION SUPPRESSION SYSTEM BY REMOVING THE FUSE FROM THE TOP OF THE SUPPRESSOR IN THE FIN, AS DETAILED IN 26-31-12, REMOVAL/ INSTALLATION.

1. General

This topic comprises separate procedures for the removal and installation of the various pipes in the vent and pressurization system, together with a Preparation procedure (Ref. para.2.) that is common to all pipes in the tail cone. If removal of a single pipe is required, the appropriate part of these procedures must be followed.

When Gamah couplings are being installed, the general requirements detailed in 20-23-21 and the pipe insertion dimensions (end-float) must be observed. Pipe insertion dimensions for the pipes in the tail cone are shown in the illustration (Ref. Fig. 403).

In the event of damage to the dry lubricant coating on the Gamah couplings, the procedure for the application of dry lubricant must be followed in accordance with 20-24-35.

2. Preparation (Tail Cone Pipes)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove Pipes

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00,

Servicing) and that the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that the settings of the switches must not be altered.

(3) Lower the tail gear; fit a locking sleeve to the gear jack (Ref. 12-37-00, Tail Gear Wheel).

(4) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16
RH VENT VALVE SUP	3-213	Q723	D7
LH VENT VALVE SUP	1-213	Q722	K16
FUEL VENT IGN PROTN SYS SUP	1-213	W501	P21

(5) Remove the fuse from the top of the suppressor in the fin as detailed in 26-31-12, Removal/Installation.

**ON A/C 001-005,
3. <u>Bulkhead-mounted Pipe (RH)</u> (Ref. Fig. 401) (Sheet 1)

R **ON A/C 006-007,
3. <u>Bulkhead-mounted Pipe (RH)</u> (Ref. Fig. 402) (Sheet 1)

<u>WARNING</u>: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

**ON A/C 001-005,

R **ON A/C 006-007,

B. Prepare to Remove Bulkhead-mounted Pipe (RH)

(1) Carry out the procedures detailed in paragraph 2.B.

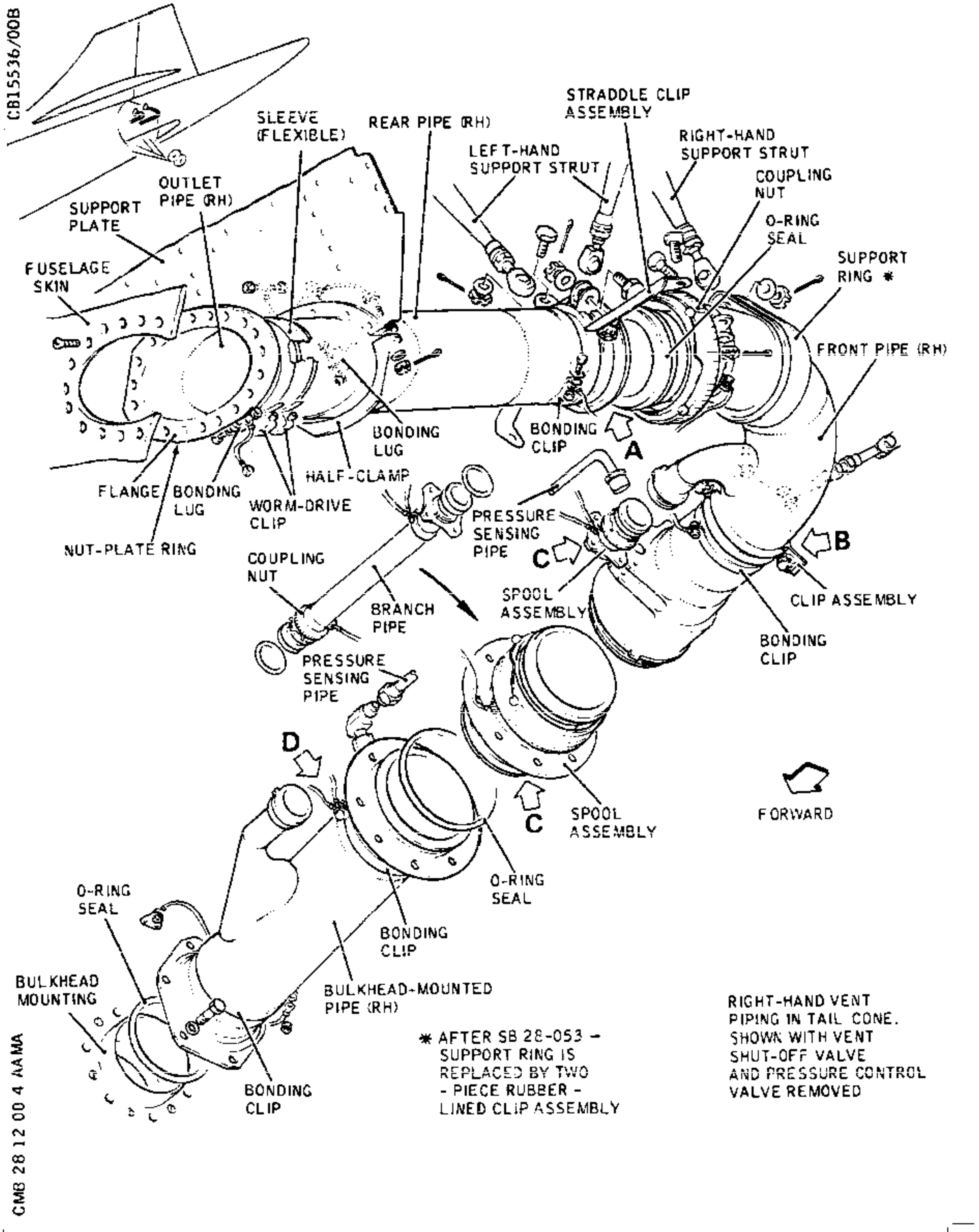
(2) Remove the vent shut-off valve (RH) and pressure control valve as detailed in 28-12-51, Removal/ Installation.

C. Remove Bulkhead-mounted Pipe (RH)

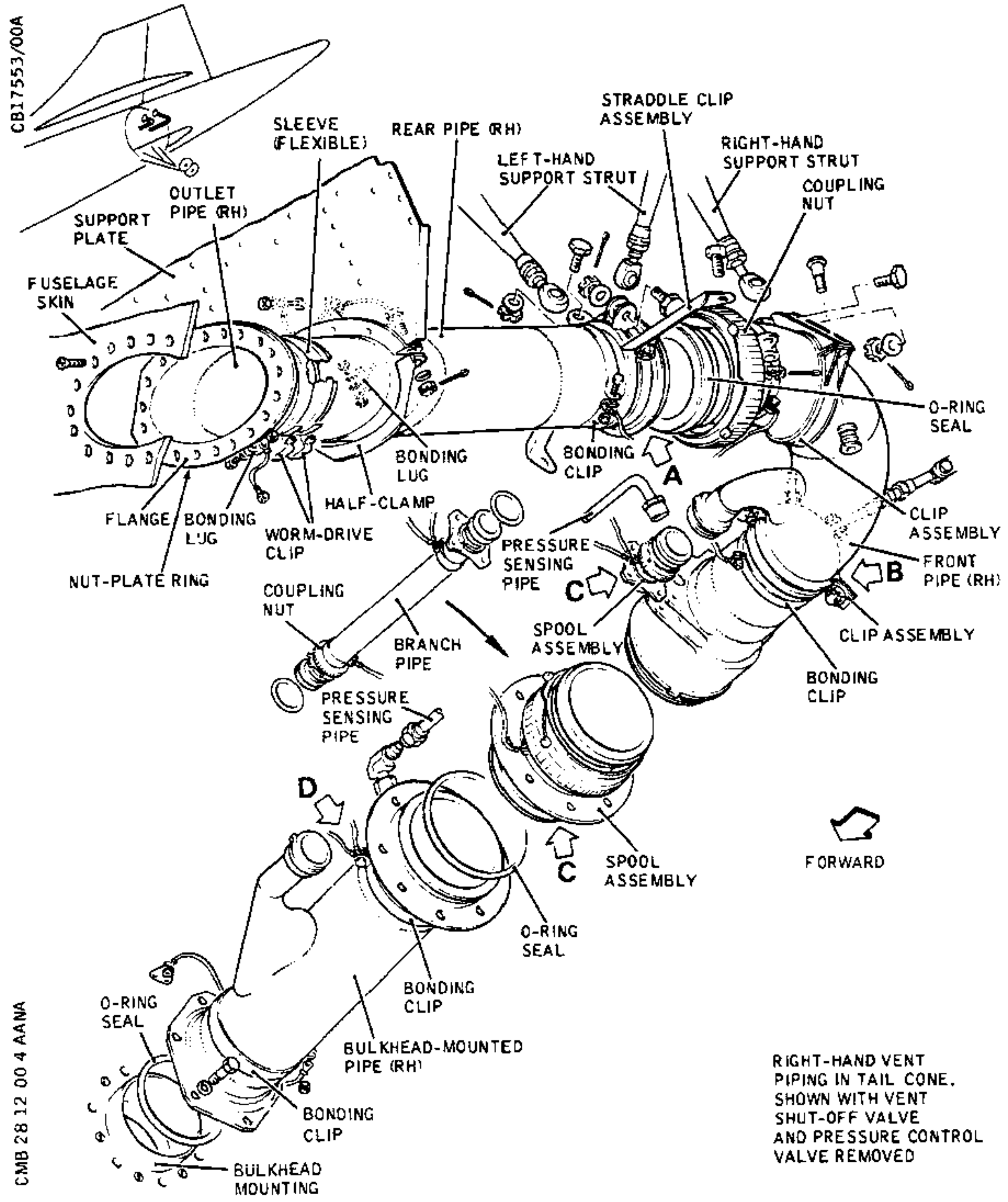
(1) Note the position of all bonding leads, ligatures and clips.

(2) Carefully cut and remove the ligatures securing the bonding leads.

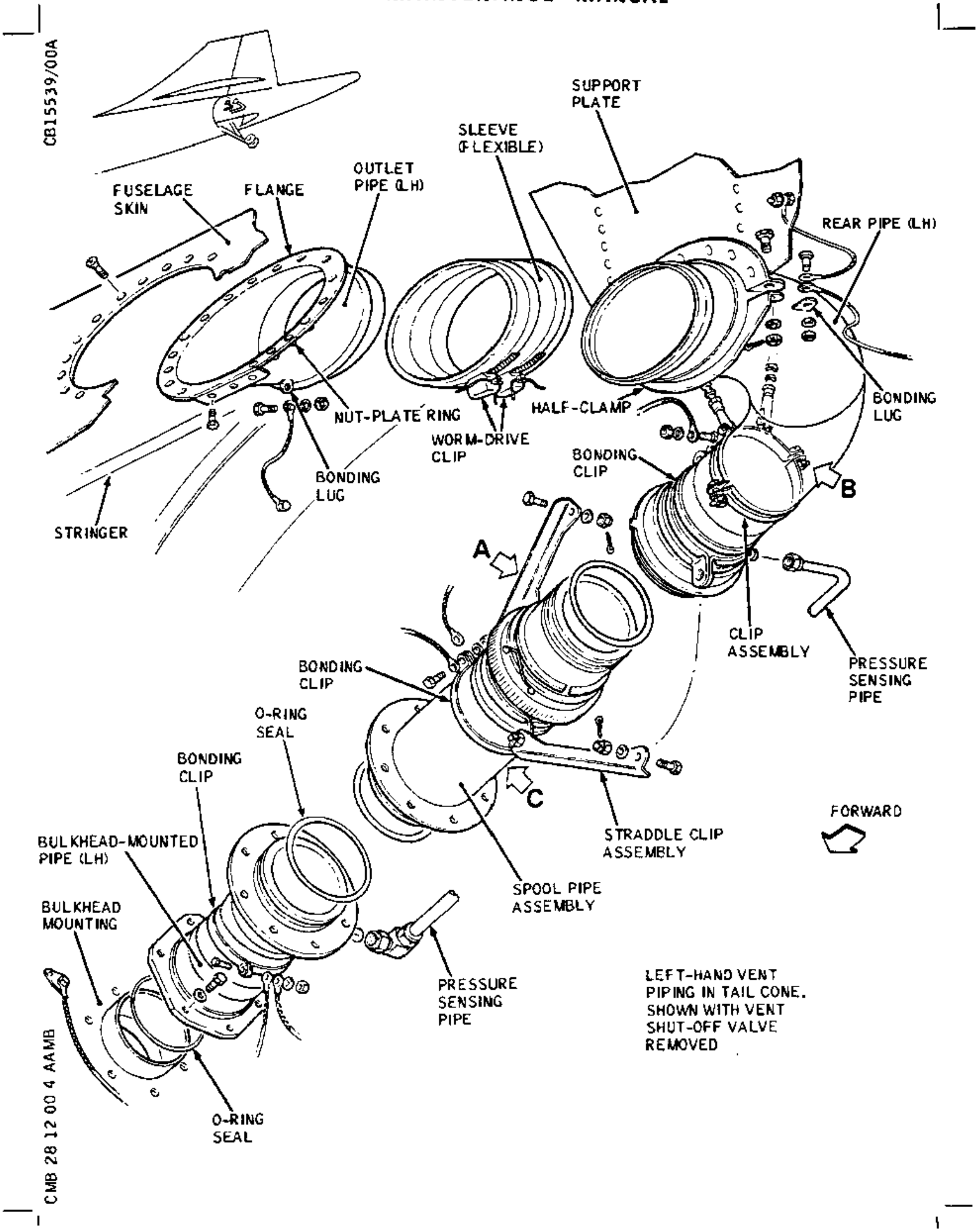
(3) Remove the nuts, washers and bolts securing the bonding leads to the clips on the bulkhead-mounted pipe and the branch pipe. Carefully move the clips away from the couplings, ensuring that the protective treatment is not damaged.



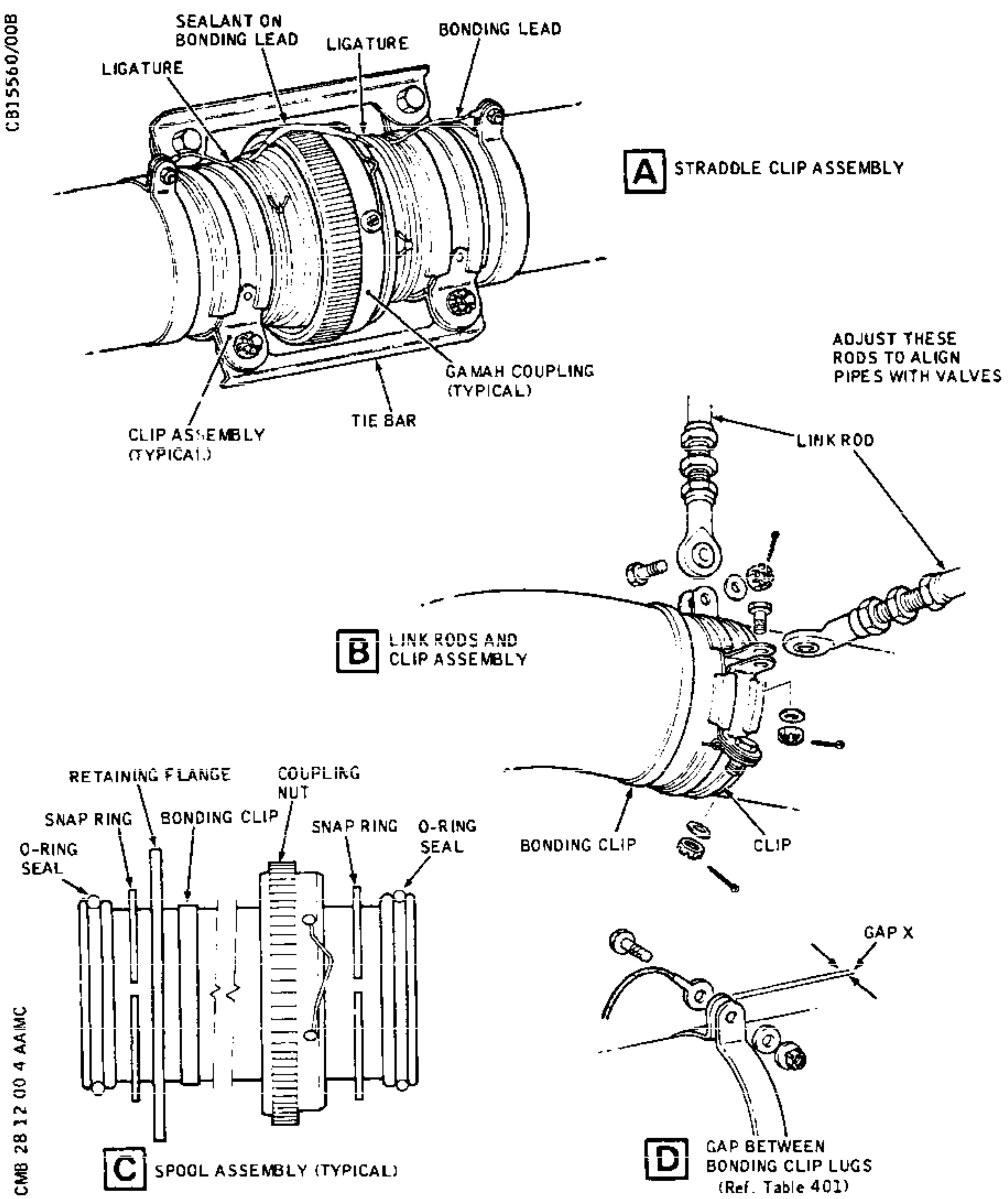
R - Pipes and Attachments - Installation (Sheet 1 of 3)
Figure 401



- Pipes and Attachments - Installation (Sheet 1 of 3)
Figure 402



- Pipes and Attachments - Installation (Sheet 2 of 3)
Figure 401



- Pipes and Attachments - Installation (Sheet 3 of 3)
R Figure 401

(4) Fully unscrew the coupling nut at the forward end of the branch pipe; remove the branch pipe.

(5) Unscrew the union nut of the pressure sensing pipe.

(6) Remove the bolts and washers securing the pipe flange to the bulkhead mounting; disengage the pipe from the bulkhead mounting and remove it.

(7) Remove and discard the O-ring seals from the pipe and branch pipe.

(8) Remove the coupling components and bonding clips from the pipes.

(9) Fit suitable blanks to the open ends of all pipes.

D. Install Bulkhead-mounted Pipe (RH)

CAUTION: DURING INSTALLATION, CHECK THAT THE PIPE INSERTION DIMENSIONS ARE CORRECT (Ref. Fig. 403).

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipes; ensure that the pipe and branch pipe joints are clean.

(3) Fit the bonding clips and coupling components (Ref. 20-23-21) to the pipe and branch pipe.

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the pipe flanges.

(5) Position the bulkhead-mounted pipe, fitting the forward flange over the bulkhead mounting, ensuring that the O-ring seal is not displaced.

(6) Secure the forward flange to the bulkhead mounting with the six bolts and washers; torque-tighten each bolt to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(7) Fit the forward end of the branch pipe into the branch of the bulkhead-mounted pipe; tighten and lock the coupling nut in accordance with 20-23-21.

(8) Reconnect the pressure sensing pipe, torque-tightening the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(9) Install the vent shut-off valve (RH) and pressure control valve as detailed in 28-12-51, Removal/ Installation.

(10) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 401). Connect the bonding lead, in accordance with 20-27-11, using the bolt, washer(s) and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(11) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(12) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(13) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

GAP X, WITH LUGS HELD TOGETHER BY FINGER PRESSURE	SPACING WASHER(S) TO BE FITTED BETWEEN LUGS	
	WASHER	QTY.
0.010 to 0.059 in (0.254 to 1.498 mm)	-	0
0.060 to 0.119 in (1.524 to 3.022 mm)	Y	1
0.120 to 0.169 in (3.048 to 4.292 mm)	Z	1
0.170 to 0.209 in (4.318 to 5.308 mm)	Y and Z	1 of each

NOTE: Washer Y thickness: 0.048 in (1.219 mm)

Washer Z thickness: 0.104 in (2.641 mm)

Bonding Clip Lug Gap and Spacing Washers (Ref. Fig.401)
Table 401

E. Conclusion

(1) Check that the electrical bonding between the pipes and components is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-00, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

R **ON A/C 001-005,

4. Front Pipe (RH) (Ref. Fig. 401) (Sheet 1)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 100 lbf in (1.130 mdaN)	-
Sealant, PR 1422BT	-

DESCRIPTION	PART NO.
R (Ref. 20-30-00, No.357)	
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

B. Prepare to Remove Front Pipe (RH)

(1) Carry out the procedures detailed in paragraph 2.B.

(2) Remove the vent shut-off valve (RH) and pressure control valve as detailed in 28-12-51, Removal/ Installation.

C. Remove Front Pipe (RH)

(1) Note the position of all bonding leads, ligatures and clips.

(2) Carefully cut and remove the ligatures securing the bonding leads.

(3) Remove the nuts, washers and bolts securing the bonding leads to the clips on the pipe and spools. Carefully move the clips away from the couplings, ensuring that the protective treatment is not damaged.

(4) Fully unscrew the coupling nut at the spool assemblies (Detail C); remove the two spools.

(5) Unscrew the union nut of the pressure sensing pipe.

(6) Remove the split pins, nuts, bolts and washers to release the tie bars and straddle clip assembly (Detail A); fully unscrew the coupling nut.

Before SB 28-053

(7) Remove the split pin, nut, bolt and washer securing the right-hand support strut to the pipe.

R (7) Remove the split pin, nut, bolt and washer securing
R the right-hand support strut to the clip assembly.
R If the pipe is to be renewed, remove the 'Hi-Lok'
R pins and collars securing the clip assembly to the
R pipe, in accordance with 20-21-15.

(8) Remove the split pins, nuts, bolts and washers securing the two link rods and clip assembly (Detail B); remove the pipe.

R NOTE: Any shims that may have been used for clip
R assembly packing must be retained.

(9) Remove and discard the O-ring seals from the pipe flange and spools.

(10) Remove the coupling components and bonding clips from the pipe and spools.

(11) Fit suitable blanks to the open ends of all pipes.

D. Install Front Pipe (RH)

CAUTION: DURING INSTALLATION, CHECK THAT THE PIPE INSERTION DIMENSIONS ARE CORRECT (Ref. Fig. 403).

NOTE: Split pins must be fitted in accordance with 20-21-12.

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Fit the coupling components (Ref. 20-23-21) and bonding clips to the pipe and spools (Detail C).

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the pipe flange and spools.

(5) Position the pipe, inserting the rearward end into the adjoining pipe sleeve.

R (6) Position and hold the clip assembly around the pipe
R (Detail B). Check that the gap between the lugs is
R between 0.015 and 0.030 in (0.381 and 0.762 mm).

R If required, fit shim washers between the lugs. Secure the clip assembly to the pipe with the bolts, washers and nuts; check that the clip is aligned with the link rods and then torque-tighten each clip assembly nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(7) Secure the link rods to the clip with the bolts, washers and nuts; torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

<u>NOTE</u>: The link rods may be adjusted to achieve pipe alignment; after adjustment the rod locknuts must be torque-tightened to 100 lbf in (1.130 mdaN) and each locknut wire-locked to its serrated locking plate in accordance with 20-21-13.

R After adjustment, it must be ensured that the
R rod-ends are in safety.

R Before SB 28-053

(8) Secure the right-hand support strut to the pipe fitting with the bolt, washer and nut; torque-tighten the nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

R After SB 28-053 For A/C 001-005,

R (8) If a new pipe is being fitted, align the clip
R assembly with the right-hand support strut and
R proceed as follows:-

R (a) Position and hold the clip assembly around the
R pipe. Check that the gap between the lugs is
R between 0.015 and 0.030 in (0.381 and 0.762 mm).
R If required, fit shim washers between the lugs.

R (b) Secure the clip assembly with the 'Hi-Lok' pins
R and collars in accordance 20-21-15.

R (c) Secure the right-hand support strut to the clip
R with the bolt, washer and nut; torque-tighten
R the nut to between 25 and 30 lbf in (0.282 and
R 0.339 mdaN) and lock it with a split pin.

(9) Tighten and lock the coupling nut in accordance with 20-23-21.

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(10) Secure the straddle clip and tie bars (Detail A) to the pipes with the bolts, washers and nuts; torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(11) Reconnect the pressure sensing pipe, torque-tightening the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(12) Fit the two spools (Detail C) to the pipe; tighten and lock the coupling nuts in accordance with 20-23-21.

(13) Install the vent shut-off valve and pressure control valve as detailed in 28-12-51, Removal/Installation.

R (14) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 401). Connect the bonding leads, in accordance with 20-27-11, using the bolt, washer(s) and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(15) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(16) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(17) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes and components is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated

system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

R **ON A/C 006-007,

4. Front Pipe (RH) (Ref. Fig. 402) (Sheet 1)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 100 lbf in (1.130 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

B. Prepare to Remove Front Pipe (RH)

(1) Carry out the procedures detailed in paragraph 2.B.

(2) Remove the vent shut-off valve (RH) and pressure

control valve as detailed in 28-12-51, Removal/ Installation.

C. Remove Front Pipe (RH)

(1) Note the position of all bonding leads, ligatures and clips.

(2) Carefully cut and remove the ligatures securing the bonding leads.

(3) Remove the nuts, washers and bolts securing the bonding leads to the clips on the pipe and spools. Carefully move the clips away from the couplings, ensuring that the protective treatment is not damaged.

(4) Fully unscrew the coupling nut at the spool assemblies (Detail C); remove the two spools.

(5) Unscrew the union nut of the pressure sensing pipe.

(6) Remove the split pins, nuts, bolts and washers to release the tie bars and straddle clip assembly (Detail A); fully unscrew the coupling nut.

(7) Remove the split pin, nut, bolt and washer securing the right-hand support strut to the clip assembly. If the pipe is to be renewed, remove the 'Hi-Lok' pins and collars, securing the clip assembly to the pipe, in accordance with 20-21-15.

(8) Remove the split pins, nuts, bolts and washers securing the two link rods and clip assembly (Detail B); remove the pipe.

NOTE: Any shims that may have been used for clip assembly packing must be retained.

(9) Remove and discard the O-ring seals from the pipe flange and spools.

(10) Remove the coupling components and bonding clips from the pipe and spools.

(11) Fit suitable blanks to the open ends of all pipes.

D. Install Front Pipe (RH)

CAUTION: DURING INSTALLATION, CHECK THAT THE PIPE INSERTION DIMENSIONS ARE CORRECT

(Ref. Fig. 403).

NOTE: Split pins must be fitted in accordance with 20-21-12.

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Fit the coupling components (Ref. 20-23-21) and bonding clips to the pipe and spools (Detail C).

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the pipe flange and spools.

(5) Position the pipe, inserting the rearward end into the adjoining pipe sleeve.

(6) Position and hold the clip assembly around the pipe (Detail B). Check that the gap between the lugs is between 0.015 and 0.030 in (0.381 and 0.762 mm). If required, fit shim washers between the lugs.

(7) Secure the clip assembly to the pipe with the bolts, washers and nuts; check that the clip is aligned with the link rods and then torque-tighten each clip assembly nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(8) Secure the link rods to the clip with the bolts, washers and nuts; torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

NOTE: The link rods may be adjusted to achieve pipe alignment; after adjustment the rod locknuts must be torque-tightened to 100 lbf in (1.130 mdaN) and each locknut wire-locked to its serrated locking plate in accordance with 20-21-13.

After adjustment, it must be ensured that the rod-ends are in safety.

(9) If a new pipe is being fitted, align the clip assembly with the right-hand support strut. Position and hold the clip assembly around the pipe. Check that the gap between the lugs is between 0.015 and 0.030 in (0.381 and 0.762 mm). If required, fit shim washers

between the lugs.

(10) Secure the clip assembly with the 'Hi-Lok' pins and collars in accordance with 20-21-15. Secure the right-hand support strut to the clip with the bolt, washer and nut; torque-tighten the nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(11) Tighten and lock the coupling nut in accordance with 20-23-21.

(12) Secure the straddle clip and tie bars (Detail A) to the pipes with the bolts, washers and nuts; torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(13) Reconnect the pressure sensing pipe, torque-tightening the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(14) Fit the two spools (Detail C) to the pipe; tighten and lock the coupling nuts in accordance with 20-23-21.

(15) Install the vent shut-off valve and pressure control valve as detailed in 28-12-51, Removal/Installation.

(16) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 402). Connect the bonding lead, in accordance with 20-27-11, using the bolt, washer(s) and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(17) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(18) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(19) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes

and components is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

5. Rear Pipe (RH) (Ref. Fig. 401) (Sheet 1)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 50 to 60 lbf in (0.565 to 0.678 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material,	-

DESCRIPTION	PART NO.
R NOMEX cord R (Ref. 20-30-00, No.163)	

B. Prepare to Remove Rear Pipe (RH)

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Rear Pipe (RH)

(1) Note the position of all bonding leads and attachments.

(2) Carefully cut and remove the ligatures securing the bonding leads.

(3) Remove the nuts, washers and bolts securing the bonding leads to the clip and lug on the pipe. Carefully move the clip toward the centre of the pipe, ensuring that the protective treatment is not damaged.

(4) Remove the split pins, nuts, bolts and washers securing the two left-hand support struts to the straddle clip assembly (Detail A).

(5) Remove the split pins, nuts, bolts and washers to release the tie bars and straddle clip assembly (Detail A); fully unscrew the coupling nut.

(6) At each end of the flexible sleeve, release each worm-drive of the double worm-drive clips. Carefully slide the clips and sleeve toward the centre of the pipe, ensuring that the protective treatment is not damaged.

(7) Remove the split pins, nuts, bolts and washers securing the half-clamp to the support plate; remove the half-clamp and disengage and remove the pipe from adjoining pipe flange.

(8) Remove and discard the O-ring seal from the adjoining pipe flange.

(9) Remove the bonding clip, worm-drive clips and flexible sleeve from the pipe.

(10) Fit suitable blanks to the open ends of all pipes.

D. Install Rear Pipe (RH)

NOTE: Split pins must be fitted in accordance with 20-21-12.

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the adjoining pipe flange.

(4) Ensure that the flexible sleeve is not worn or damaged; renew the sleeve if necessary. Carefully
R slide the double worm-drive clips and flexible sleeve on to the pipe.

(5) Position the pipe sleeve over the adjoining pipe flange and slide the flexible sleeve into position over the outlet pipe.

R NOTE: The gap between the pipes should be
R approximately 0.50 in (12.70 mm), and the
R sleeve should overlap each pipe-end by
R approximately 1.380 in (35.052 mm).

(6) Tighten and lock the coupling nut in accordance with 20-23-21.

(7) Secure the straddle clip and tie bars (Detail A) to the pipes with the bolts, washers and nuts; ensure that the clip is aligned with the left-hand support struts and then torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(8) Secure the left-hand support struts to the clip with the bolts, washers and nuts; torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(9) Check that the half-clamp rubber liner is not worn or damaged. Fit a new rubber liner if necessary, sealing it to the half-clamp, in accordance with 20-25-13, with the liner protruding equally from both sides of the clamp.

(10) Fit the half-clamp around the pipe and secure it to the support plate with the two bolts, nuts and washers; torque-tighten each nut to between 50 and 60 lbf in (0.565 and 0.678 mdaN) and lock it with a a split pin.

R (11) Position the double worm-drive clips on the flexible sleeve with their screws at each end of the greatest diameter of the pipe. Check, by inspecting the bore of the pipe, that the packing strip, attached to the inside of the sleeve, is correctly located between the two pipe ends. Torque-tighten each screw equally to between 14 and 18 lbf in (0.158 and 0.203 mdaN), and wire-lock it in accordance with 20-21-13.

R (12) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 401). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washer(s) and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(13) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(14) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(15) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes and structure is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures

(Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

6. Outlet Pipe (RH) (Ref. Fig. 401) (Sheet 1)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque screwdriver, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Viton sealant, PR 1720F (Ref. 20-30-00, No.352)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Outlet Pipe (RH)

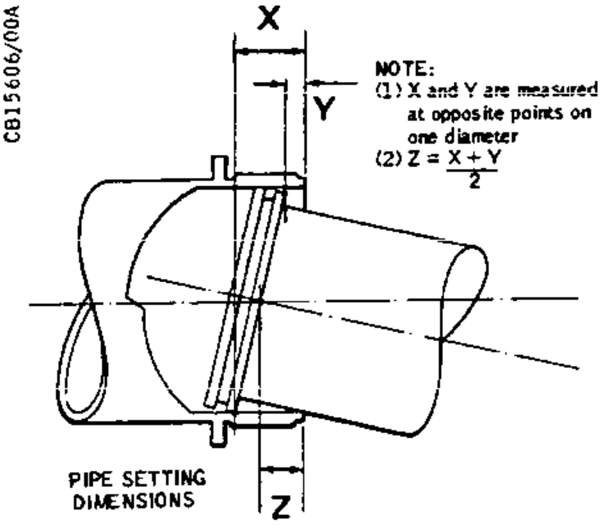
(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Outlet Pipe (RH)

(1) Note the position of the bonding lead attachment.

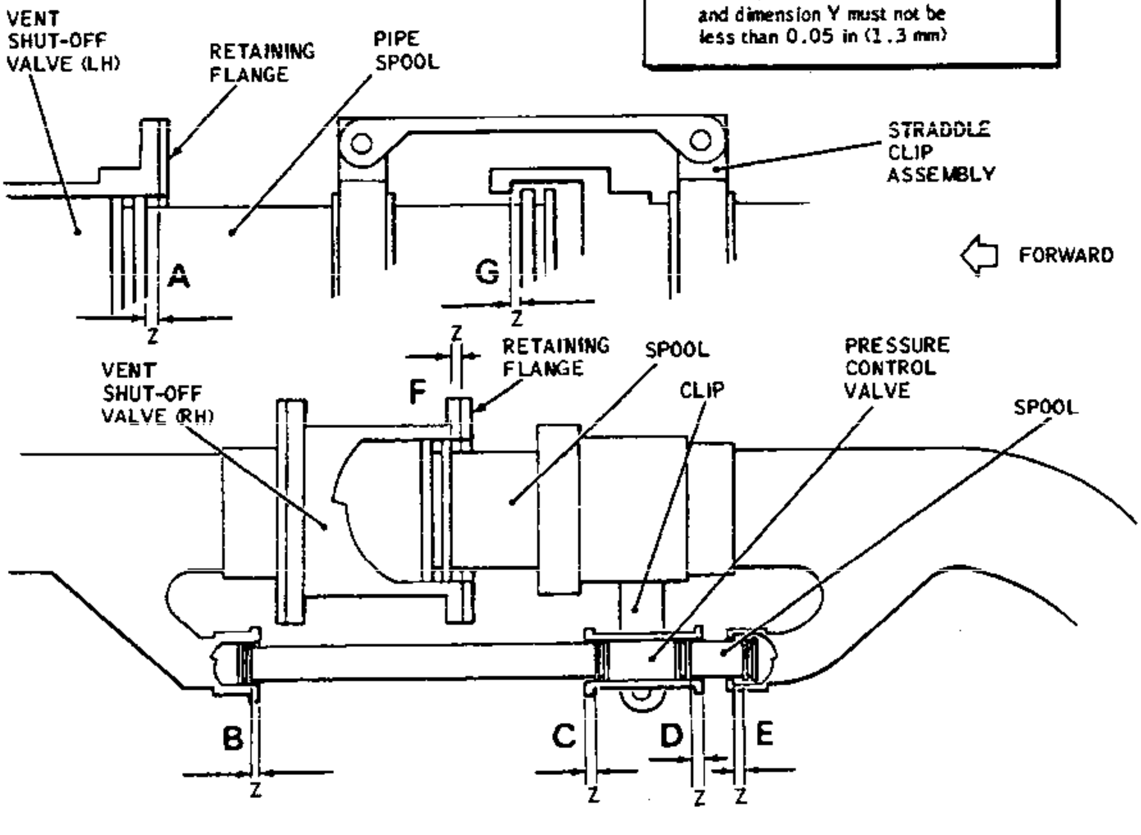
(2) Remove the nut, washer and bolt securing the bonding lead to the lug on the pipe.

R (3) Release the screws on the double worm-drive clips securing the flexible sleeve; carefully slide the
R double clips and sleeve toward the centre of the rear pipe (RH), ensuring that the protective treatment is not damaged.

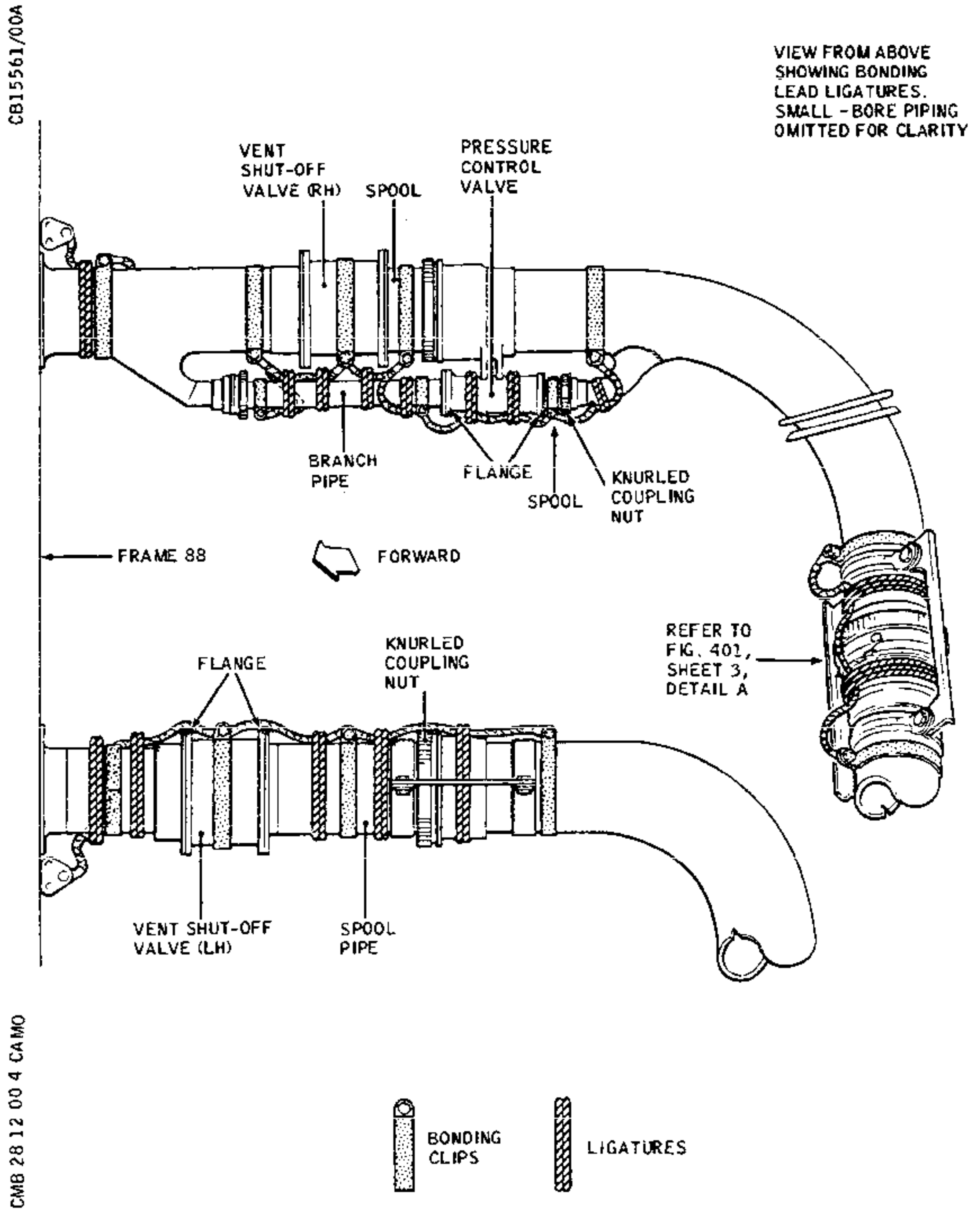


JOINT	INSERTION DIMENSION Z	
	in	mm
A	0.2 (±0.05)	5.1 (±1.3)
B	0.2 (+0.10 / -0.05)	5.1 (+2.5 / -1.3)
C D F	0.2 (+0.02)	5.1 (±0.5)
E	0.2 (±0.15)	5.1 (±3.8)

NOTE:
At joint **G**, dimension X minus Y must not exceed 0.15 in (3.8 mm) and dimension Y must not be less than 0.05 in (1.3 mm)



\- Pipe Insertion Dimensions
Figure 403



\- Bonding Lead Ligatures
Figure 404

(4) From outside the fuselage skin, remove the bolts securing the pipe flange and nutplate ring to the skin.

(5) Using a non-metallic wedge, carefully prise the pipe flange from the fuselage skin and remove the pipe.

(6) Remove the sealant, using a suitable solvent (Ref. 28-11-00, Approved Repairs).

(7) Remove the worm-drive clips and flexible sleeve from the rear pipe (RH).

(8) Remove the nutplate ring from the pipe.

(9) Fit suitable blanks to the open ends of all pipes.

E. Install Outlet Pipe (RH)

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Ensure that the flexible sleeve is not worn or damaged; renew the sleeve if necessary. Carefully slide the worm-drive clips and flexible sleeve on to the rear pipe (RH).

(4) Fit the nutplate ring to the outlet pipe.

(5) Seal the outlet pipe flange to the fuselage skin with Viton sealant PR 1720F in accordance with 20-22-12, and secure the flange and nutplate ring with the bolts; torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN). Ensure that the sealant exudes from the joint to form a bead in the joint chamfer; this bead may be formed into a smooth fillet by adding gap filler in accordance with 20-22-11.

R (6) Slide the flexible sleeve and double worm-drive clips
R into position, with the screws on the clips at each
R end of the greatest diameter of the pipe. Check, by inspecting the bore of the pipe, that the packing strip, attached to the inside of the sleeve, is correctly located between the two pipe ends. Torque-
R tighten each screw equally to between 14 and 18 lbf in (0.158 and 0.203 mdaN), and wire-lock it in accordance

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R with 20-21-13.

R NOTE: The gap between the pipes should be
R approximately 0.50 in (12.70 mm), and the
R sleeve should overlap each pipe-end by
R approximately 1.380 in (35.052 mm).

(7) Connect the bonding lead to the lug on the pipe, in accordance with 20-27-11, using the bolt, washer and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(8) Coat all bolts and nuts, securing the pipe attachments inside the tail cone, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipe and structure is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

7. Bulkhead-mounted Pipe (LH) (Ref. Fig. 401) (Sheet 2)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-

DESCRIPTION	PART NO.
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

B. Prepare to Remove Bulkhead-mounted Pipe (LH)

(1) Carry out the procedures detailed in paragraph 2.B.

(2) Remove the vent shut-off valve (LH) as detailed in 28-12-51, Removal/Installation.

C. Remove Bulkhead-mounted Pipe (LH)

(1) Note the position of all bonding leads, ligatures and clips.

(2) Carefully cut and remove the ligatures securing the bonding leads.

(3) Remove the nut, washer and bolt securing the bonding leads to the clip on the pipe.

(4) Unscrew the union nut of the pressure sensing pipe.

(5) Remove the bolts and washers securing the pipe flange to the bulkhead mounting; disengage the pipe from the bulkhead mounting and remove it.

(6) Remove and discard the O-ring seals from the pipe.

(7) Remove the bonding clip from the pipe.

(8) Fit suitable blanks to the open ends of all pipes.

D. Install Bulkhead-mounted Pipe (LH)

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joint are clean.

(3) Fit the bonding clip to the pipe.

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the pipe.

(5) Position the pipe, fitting the forward flange over the bulkhead mounting, ensuring that the O-ring seal is not displaced.

(6) Secure the flange to the bulkhead mounting with the six bolts and washers; torque-tighten each bolt to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(7) Reconnect the pressure sensing pipe, torque-tightening the coupling nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(8) Install the vent shut-off valve (LH) as detailed in 28-12-51, Removal/Installation.

R (9) Reposition the bonding clip and determine the quantity
R and thickness of the spacing washers to be fitted
R between the lugs, as detailed in Table 401
R (Ref. Fig. 401). Connect the bonding lead, in
R accordance with 20-27-11, using the bolt, washer(s)
R and nut; torque-tighten the nut to between 9 and 11
R lbf in (0.102 and 0.124 mdaN).

(10) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(11) Apply a brush-coating of sealant PR 1422BT to the bonding leads in the area of possible contact with the pipe rear flange.

(12) Coat all bolts and nuts, securing the pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipe,

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valve and structure is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-00, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

8. Spool Pipe (LH) (Ref. Fig. 401) (Sheet 2)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

B. Prepare to Remove Spool Pipe (LH)

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Spool Pipe (LH)

(1) Note the position of all bonding leads, ligatures and clips.

(2) Carefully cut and remove the ligatures securing the bonding leads.

(3) Remove the nut, washer and bolt securing the bonding leads to the clip on the spool pipe.

(4) Remove the vent shut-off valve (LH) as detailed in 28-12-51, Removal/Installation.

(5) Remove the straddle clip assembly attachments (Detail A) from the spool pipe and fully unscrew the coupling nut; disengage and remove the pipe from the adjoining pipe sleeve.

(6) Remove and discard the O-ring seals from the spool pipe flanges.

(7) Remove the coupling components (Detail C) and bonding clip from the spool pipe.

(8) Fit suitable blanks to the open ends of all pipes.

D. Install Spool Pipe (LH)

CAUTION: DURING INSTALLATION, CHECK THAT THE PIPE INSERTION DIMENSIONS ARE CORRECT (Ref. Fig. 403).

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Fit the bonding clip and coupling components (Detail C) to the spool pipe.

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the spool pipe.

(5) Slide the spool pipe fully into the adjoining pipe sleeve and loosely connect the coupling nut.

(6) Install the vent shut-off valve (LH) as detailed in 28-12-51, Removal/Installation.

R (7) Reposition the bonding clip and determine the quantity
R and thickness of the spacing washers to be fitted

R between the lugs, as detailed in Table 401
R (Ref. Fig. 401). Connect the bonding lead, in
R accordance with 20-27-11, using the bolt, washer(s)
R and nut; torque-tighten the nut to between
R 9 and 11 lbf in (0.102 and 0.124 mdaN).

(8) Apply ligatures and sealant in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 404).

(9) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(10) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

9. <u>Rear Pipe (LH)</u> (Ref. Fig. 401) (Sheet 2)

<u>WARNING</u>: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 50 to 60 lbf in (0.565 to 0.678 mdaN)	-
Torque spanner, 100 lbf in (1.130 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	-

B. Prepare to Remove Rear Pipe (LH)

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Rear Pipe (LH)

(1) Note the position of all bonding lead attachments.

(2) Remove the nuts, washers and bolts securing the bonding leads to the clip and lug on the pipe.

(3) Remove the split pins, nuts, bolts and washers to release the tie bars and straddle clip assembly (Detail A); fully unscrew the coupling nut.

(4) Unscrew the union nut of the pressure sensing pipe.

R (5) Release the screws on the double worm-drive clips securing the flexible sleeve; carefully slide the
R double clips and sleeve toward the centre of the pipe, ensuring that the protective treatment is not damaged.

(6) Remove the split pins, nuts, bolts and washers securing the half-clamp to the support plate; remove the half-clamp and rubber liner.

(7) Remove the split pins, nuts, bolts and washers securing the two link rods and clip assembly (Detail B).

R NOTE: Any shim washers that were used for clip
R assembly packing must be retained.

(8) Disengage the pipe sleeve from the spool pipe and remove the pipe.

(9) Remove and discard the O-ring seal from the spool pipe flange.

(10) Remove the flexible sleeve, worm-drive clips and bonding clip from the pipe.

(11) Fit suitable blanks to the open ends of all pipes.

D. Install Rear Pipe (LH)

NOTE: Split pins must be fitted in accordance with 20-21-12.

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks and ensure that the pipes and joints are clean.

(3) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the spool pipe flange.

(4) Ensure that the flexible sleeve is not worn or damaged; renew the sleeve if necessary. Carefully
R slide the bonding clip, double worm-drive clips and flexible sleeve on to the pipe.

(5) Position the pipe sleeve over the adjoining spool pipe flange and slide the flexible sleeve into

position over the outlet pipe.

NOTE: The gap between the pipes should be approximately 0.50 in (12.70 mm), and the sleeve should overlap each pipe-end by approximately 1.380 in (35.052 mm).

(6) Tighten and lock the coupling nut in accordance with 20-23-21.

(7) Secure the straddle clip and tie bars (Detail A) to the pipes with the bolts, washers and nuts; torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(8) Position and hold the clip assembly around the pipe (Detail B). Check that the gap between the lugs is between 0.015 and 0.030 in (0.381 and 0.762 mm). If required, fit shim washers between the lugs.

(9) Secure the clip assembly to the pipe with the bolts, washers and nuts; check that the clip is aligned with the link rods and then torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(10) Secure the link rods to the clip (Detail B) with the bolts, washers and nuts; torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

NOTE: The link rods may be adjusted to achieve pipe alignment; after adjustment, the rod locknuts must be torque-tightened to 100 lbf in (1.130 mdaN) and each locknut wire-locked to its serrated locking plate in accordance with 20-21-13.

If the link rods are adjusted, it must be ensured that the rod-ends are in safety.

(11) Check that the half-clamp rubber liner is not worn or damaged. Fit a new rubber liner if necessary, bonding it to the half-clamp, in accordance with 20-25-13, with the liner protruding equally from both sides of the clamp.

(12) Fit the half-clamp around the pipe and secure it to the support plate with the two bolts, nuts and washers; torque-tighten each nut to between 50 and 60 lbf in (0.565 and 0.678 mdaN) and lock it with a

split pin.

(13) Position the double worm-drive clips on the flexible sleeve with their screws at each end of the greatest diameter of the pipe. Check, by inspecting the bore of the pipe, that the packing strip, attached to the inside of the sleeve, is correctly located between the two pipe ends. Torque-tighten each screw equally to between 14 and 18 lbf in (0.158 and 0.203 mdaN), and wire-lock it in accordance with 20-21-13.

(14) Reconnect the pressure sensing pipe, torque-tightening the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(15) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 401). Connect the bonding leads to the clip and pipe/structure lugs, in accordance with 20-27-11, using the bolt, washer(s) and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(16) Apply ligatures and sealant, in accordance with 20-23-14, to secure the bonding leads as illustrated (Ref. Fig. 404).

(17) Coat the bonding leads with sealant PR 1422BT in areas of possible contact with knurled coupling nuts or flanges.

(18) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between pipes and structure is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-51, Adjustment/Test.

(3) Ensure that all tools, equipment etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Fit the fuse to the explosion suppressor in the fin and carry out an Operational Test of the associated

system in accordance with the fuse renewal procedures (Ref. 26-31-12, Removal/Installation).

(6) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(7) Remove the placards from the fuel management and refuel control panels.

10. Outlet Pipe (LH) (Ref. Fig. 401) (Sheet 2)

The removal/installation procedures for the outlet pipe (LH) are similar to those for the outlet pipe (RH) (Ref. para.6.), except that the pipe flange has an angled section that is secured to a stringer by three bolts and washers. During installation, these bolts must be torque-tightened to between 40 and 45 lbf in (0.452 and 0.508 mdaN), using a torque spanner.

11. Tank Pressurization Pipes in Fin (Ref. Fig. 405)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

CAUTION: DO NOT ALLOW DEBRIS OR LOOSE PARTS TO FALL INTO THE STRUCTURE.

A. General

For the purpose of identification within this topic, the pipes in the fin are numbered from 1 to 8.

Removal of pipe 3 as a normal maintenance practice is not possible; consequently it is not included in the following procedure, in which the pipes are removed in sequence from 1 to 8 (excluding pipe 3), and are then installed in the reverse sequence.

The procedure may be used for the removal and installation of single pipes, provided that the full Preparation (Ref. paras.C. and E.) and Conclusion (Ref. para.G.) procedures are followed.

The removal/installation of single pipes out of sequence may require adjoining pipes to be moved by slackening the clamps, in which case reference should be made to the appropriate procedure.

B. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque screwdriver, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	
Ligature material, R NOMEX cord R (Ref. 20-30-00, No.163)	
Air intake plug	E935055000

C. Prepare to Remove Tank Pressurization Pipes

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref.28-00-00, Servicing) and that the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that the settings of the switches must not be altered.

(3) Remove the appropriate access panels (Ref. Fig. 405).

<u>NOTE</u>: It is unnecessary to remove panel 323 MR for the purpose of these procedures. The panel may be removed, if required, to inspect the pipe and facilitate access to the clamp block at rib 6.

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(4) Fit the air intake plug to the air intake.

(5) To contain any debris or loose parts, suitably protect the area below the appropriate pipes.

D. Remove Tank Pressurization Pipes

(1) Remove the air intake door, panel 323 PR (Detail B), as follows:-

(a) Remove the eight countersunk bolts securing the door; lift the foward edge of the door and ease the door forward to disengage the pipe connection; remove the door complete with air intake and sleeve connector.

NOTE: The bonding lead attaching the door to the fin skin may be used as a retaining cord, or disconnected.

(2) Remove pipe 1 (Detail B), as follows:-

R (a) Note the position of all bonding leads, ligatures and clips.

R (b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the bonding lead from the clip at each end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A).

(e) Carefully cut the locking wire and remove the bolts and washers securing the special clamp block to the support bracket at spar 6.

(f) Remove the pipe; remove the split pins, nuts, bolts and washers securing the clamp block halves; release the worm-drive clips and remove the clips and flexible sleeve connecting the two sections of the pipe; discard the flexible sleeve.

(3) Remove pipe 2 (Detail B), as follows:-

R (a) Note the position of all bonding leads, ligatures and clips.

R (b) Carefully cut and remove the ligatures securing

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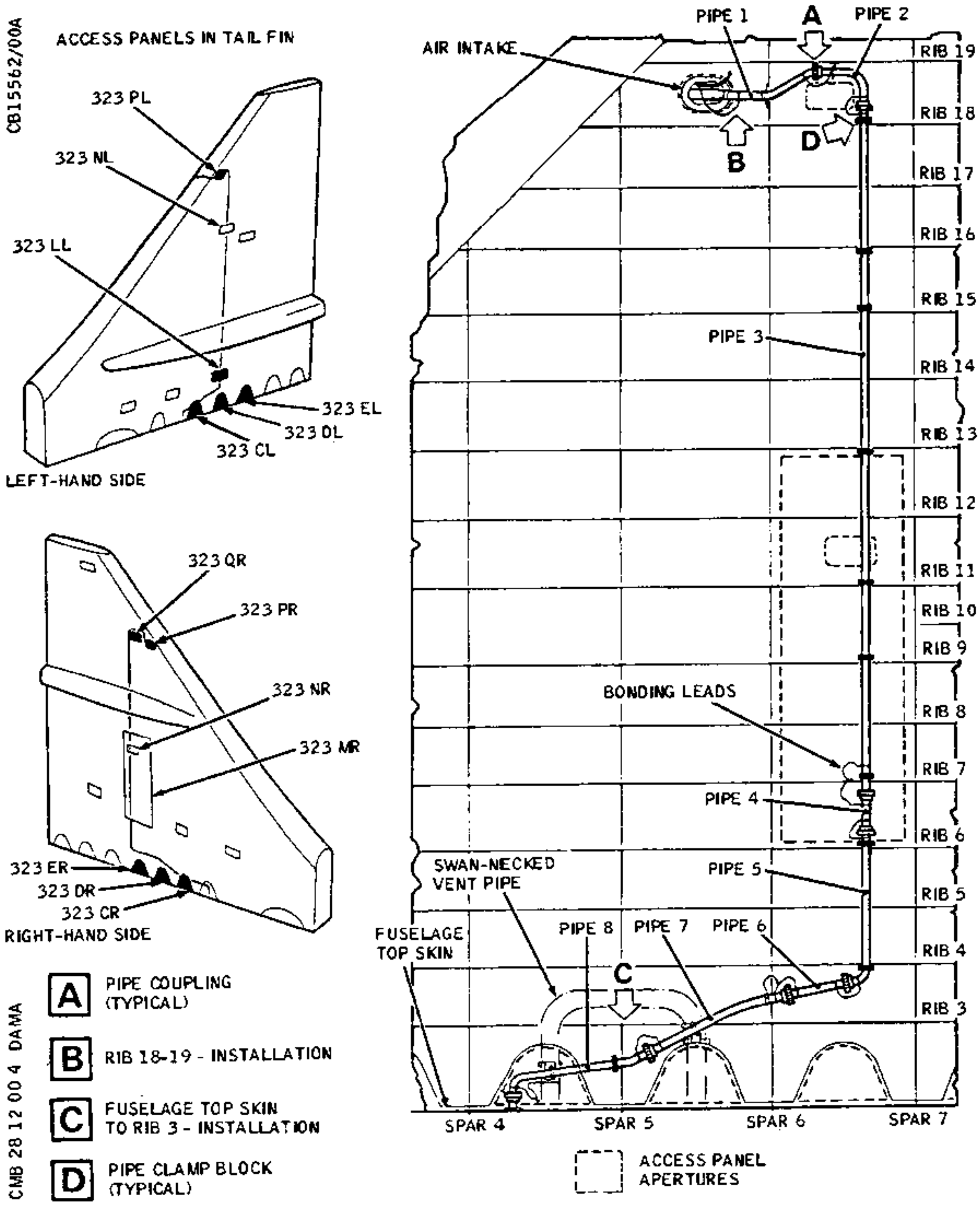
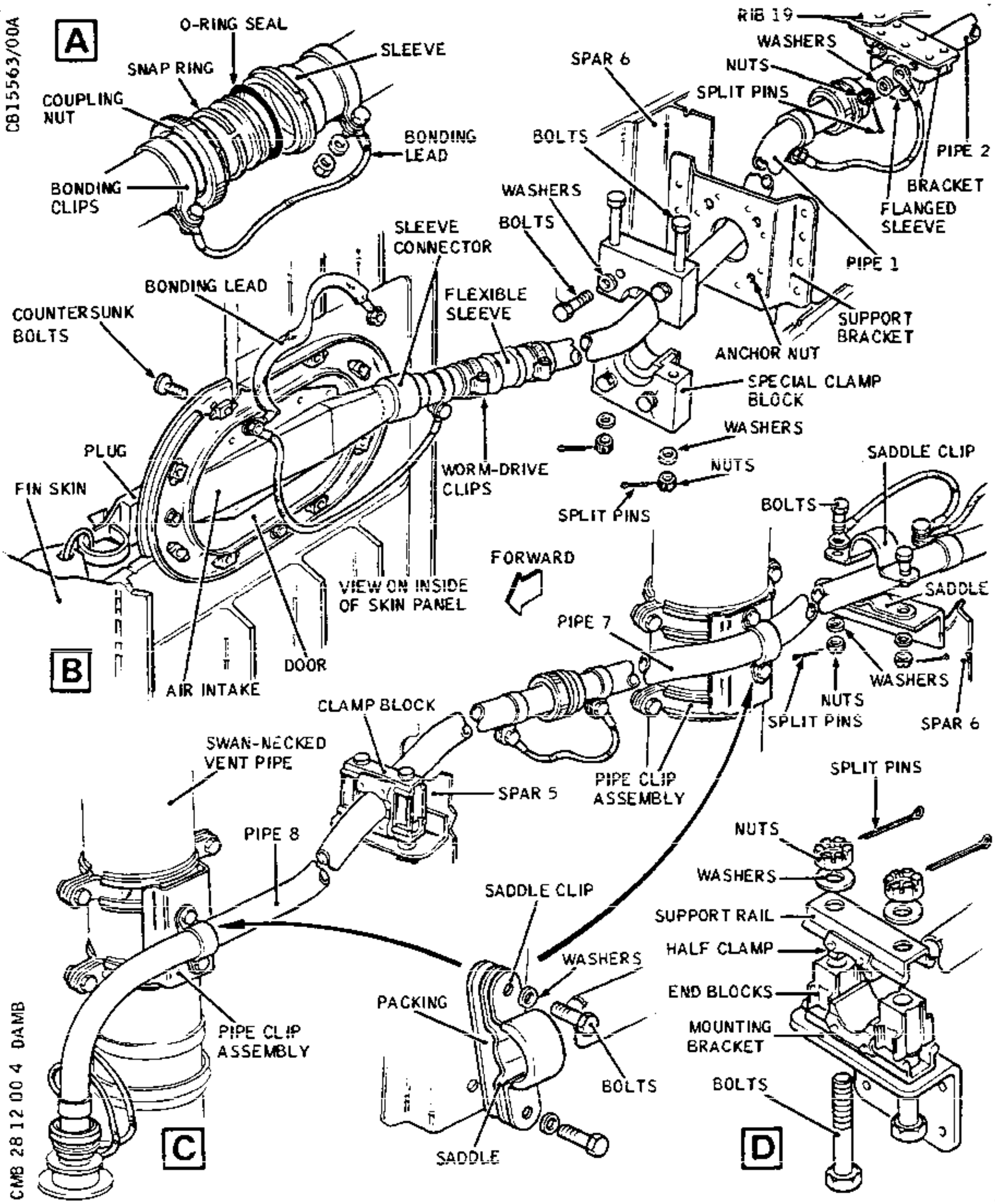


- Tank Pressurization Pipe - Installation (Sheet 1 of 2)
Figure 405



\- Tank Pressurization Pipe - Installation (Sheet 2 of 2)
Figure 405

R the bonding leads.

(c) Detach the bonding lead from the clip on the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe.

(e) Remove the split pins, nuts, washers and bolts securing the flanged sleeve and bonding lead to the bracket at rib 19; remove the pipe.

NOTE: It is not anticipated that pipe 3 will be removed during normal maintenance procedures.

(4) Remove pipe 4, as follows:-

R (a) Note the position of all bonding leads, ligatures and clips.

R (b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the bonding lead from the clip at each end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe; remove the pipe.

(5) Remove pipe 5, as follows:-

R (a) Note the position of all bonding leads, ligatures and clips.

R (b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the bonding lead from the clip at each end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe.

(e) Remove the clamp block attachments (Detail D) securing the pipe at ribs 4 and 6; remove the pipe.

(6) Remove pipe 6, as follows:-

R (a) Note the position of all bonding leads, ligatures

and clips.

(b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the bonding lead from the clip at each end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe; remove the pipe.

(7) Remove pipe 7 (Detail C), as follows:-

(a) Note the position of all bonding leads, ligatures and clips.

(b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the two bonding leads from the clip on the pipe near spar 6; also detach the bonding lead from the clip at the forward end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe.

(e) Remove the split pins, nuts, bolts and washers securing the bonding lead, saddle clip and saddle to the bracket at spar 6.

(f) Remove the bolts and washers securing the saddle clip, saddle and packing to the pipe clip assembly; remove the pipe.

(8) Remove pipe 8 (Detail C), as follows:-

(a) Note the position of all bonding leads, ligatures and clips.

(b) Carefully cut and remove the ligatures securing the bonding leads.

(c) Detach the bonding lead from the clip at each end of the pipe.

(d) Unlock and fully unscrew the coupling nut (Detail A) at each end of the pipe.

(e) Remove the bolts and washers securing the saddle

clip, saddle and packing to the pipe clip assembly.

(f) Remove the clamp block attachments (Detail D) securing the pipe at spar 5; remove the pipe.

(9) Remove and discard all O-ring seals.

(10) Remove the pipe coupling attachments (Detail A).

(11) Remove the bonding clips.

(12) Fit suitable blanks to the open ends of all pipes.

E. Prepare to Install Tank Pressurization Pipes

(1) Ensure that the fuel and electrical safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipes and fit the bonding clips.

(3) Fit the coupling components (Detail A) to the pipes in accordance with 20-23-21.

F. Install Tank Pressurization Pipes

CAUTION: ENSURE THAT THE PIPE INSERTION DIMENSIONS (END-FLOAT) ARE IN ACCORDANCE WITH 20-23-21, EXCEPT WHERE OTHERWISE STATED IN THESE PROCEDURES.

NOTE: Split pins must be fitted in accordance with 20-21-12.

(1) Install pipe 8 (Detail C), as follows;-

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the groove at each end of the pipe.

(b) Position the pipe, inserting each end into the adjoining sleeves.

(c) Assemble the clamp block (Detail D) on the pipe at spar 5 in accordance with 20-21-21; do not tighten the nuts at this stage.

(d) Check that the insertion dimension at the forward coupling is within 0.2(±0.1) in (5.08(±2.54) mm).

(e) Tighten and lock the coupling nut (Detail A) in

accordance with 20-23-21.

CAUTION: IN OPERATION (f) THE PACKING MAY BE USED AS REQUIRED TO AVOID STRAINING THE PIPE. EACH BOLT MUST BE CHECKED FOR CORRECT GRIP-LENGTH TO AVOID DAMAGE TO THE SWAN-NECKED VENT PIPE.

(f) Secure the pipe to the pipe clip assembly on the swan-necked vent pipe with the saddle clip, saddle and packing (as required), using the bolts and washers; torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(g) Torque-tighten each clamp block nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(h) Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

R (i) Apply ligatures and sealant, in accordance with
R 20-23-14, to secure the bonding leads as
R illustrated (Ref. Fig. 404).

R (j) Apply a brush-coating of sealant PR 1422BT to
R the bonding leads in areas of possible contact
R with knurled coupling nuts or flanges.

R (k) Coat all bolts and nuts, securing pipe attach-
R ments, with Viton sealant PR 1720SM, in
R accordance with 20-22-19.

(2) Install pipe 7 (Detail C), as follows:-

(a) Ensure that new O-ring seals, lubricated in accordance within 20-23-11, are fitted to the grooves in the adjoining pipes.

(b) Position the sleeve at the forward end of the pipe over the adjoining pipe.

(c) Check that the pipe insertion dimension at the coupling near spar 5 is within 0.2(±0.1) in (5.08(±2.54) mm).

(d) Tighten and lock the coupling nut (Detail A) in accordance within 20-23-21.

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(e) Secure the pipe, bonding lead, saddle and saddle clip to the bracket at spar 6, using the bolts, washers and nuts; torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

CAUTION: IN OPERATION (f) THE PACKING MAY BE USED AS REQUIRED TO AVOID STRAINING THE PIPE. EACH BOLT MUST BE CHECKED FOR CORRECT GRIP-LENGTH TO AVOID DAMAGE TO THE SWAN-NECKED VENT PIPE.

(f) Secure the pipe to the pipe clip assembly on the swan-necked vent pipe with the saddle clip, saddle and packing (as required), using the bolts and washers; torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(g) Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

R (h) Apply ligatures and sealant, in accordance with
R 20-23-14, to secure the bonding leads as
R illustrated (Ref. Fig. 404).

R (i) Apply a brush-coating of sealant PR 1422BT to
R the bonding leads in areas of possible contact
R with knurled coupling nuts or flanges.

R (j) Coat all bolts and nuts, securing pipe attach-
R ments, with Viton sealant PR 1720SM, in
R accordance with 20-22-19.

(3) Install pipe 6, as follows:-

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the groove at each end of the pipe.

(b) Position the pipe, inserting the forward end into the adjoining pipe sleeve.

(c) Check the pipe insertion dimensions and tighten and lock the coupling nut (Detail A) in accordance with 20-23-21.

(d) Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11,

using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(e) Apply ligatures and sealant, in accordance with 20-23-14, to secure the bonding leads as illustrated (Ref. Fig. 404).

(f) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(4) Install pipe 5, as follows:-

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the grooves in the upper end of the pipe and the lower adjoining pipe.

(b) Fit the sleeve at the lower end of the pipe over pipe 6.

(c) Assemble the clamp blocks (Detail D) on the pipe at ribs 4 and 6 in accordance with 20-21-21; do not tighten the nuts at this stage.

(d) Check the pipe insertion dimensions and tighten and lock the coupling nut (Detail A) in accordance with 20-23-21.

(e) Torque-tighten each clamp-block nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(f) Ensure that the bonding lead is on the opposite side of the pipes to the rudder pulley. Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(g) Apply ligatures and sealant, in accordance with 20-23-14, to secure the bonding leads as illustrated (Ref. Fig. 404).

(h) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(i) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in

R accordance with 20-22-19.

(5) Install pipe 4, as follows:-

(a) Ensure that new O-ring seals, lubricated in accordance with 20-23-11, are fitted to the grooves in the adjoining pipes.

(b) Position the sleeve at each end of the pipe over the adjoining pipes.

(c) Check the pipe insertion dimensions and tighten and lock the coupling nut (Detail A) at each end of the pipe in accordance with 20-23-21.

R (d) Ensure that the bonding lead is on the
R opposite side of the pipes to the rudder pulley. Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

R (e) Apply ligatures and sealant, in accordance with
R 20-23-14, to secure the bonding leads as
R illustrated (Ref. Fig. 404).

R (f) Apply a brush-coating of sealant PR 1422BT
R to the bonding leads in areas of possible
R contact with knurled coupling nuts or flanges.

(6) Install pipe 2 (Detail B), as follows:-

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in pipe 3.

(b) Position the sleeve at the lower end of the pipe over pipe 3, with the pipe flange on the rear side of the bracket at rib 19.

(c) Check that the pipe insertion dimension at the coupling is within 0.2(±0.1) in (5.08(±2.54) mm).

(d) Secure the flange and bonding lead to the bracket at rib 19 with the two bolts, washers and nuts; torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(e) Tighten and lock the coupling nut (Detail A) in accordance with 20-23-21.

(f) Reposition the bonding clip and connect the bonding lead, in accordance with 20-27-11, using the bolt, washer and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

R (g) Apply ligatures and sealant, in accordance with
R 20-23-14, to secure the bonding leads as
R illustrated (Ref. Fig. 404).

R (h) Apply a brush-coating of sealant PR 1422BT to the
R bonding leads in areas of possible contact with
R knurled coupling nuts or flanges.

R (i) Coat all bolts and nuts, securing pipe attach-
R ments, with Viton sealant PR 1720SM, in
R accordance with 20-22-19.

(7) Install pipe 1 (Detail B), as follows:-

NOTE: This pipe comprises two sections which are joined by a flexible sleeve.

(a) Position the two sections of the pipe, inserting the longer section through the support bracket at spar 6.

(b) Join the two sections of the pipe with a new flexible sleeve and worm-drive clips; leave a nominal 0.25 in (6.35 mm) gap between the pipe ends and then torque-tighten the screws on the clips to between 14 and 18 lbf in (0.158 and 0.203 mdaN). Wire-lock the screws in accordance with 20-21-13.

(c) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the groove at each end of the pipe.

(d) Insert the rearward end into the sleeve of pipe 2.

(e) Secure the lower half of the special clamp block to the support bracket at spar 6 with the two bolts and washers; hand-tighten the bolts only at this stage.

(f) Position the upper half of the special clamp block and secure it loosely to the lower half with the two bolts, washers and nuts.

(g) Position the pipe and check that the pipe insertion dimension at the coupling is within 0.2(±0.1) in (5.08(±2.54) mm).

(h) Tighten and lock the coupling nut (Detail A) in accordance with 20-23-21.

(i) Torque-tighten each nut securing the clamp block halves to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(j) Secure the upper half of the clamp block to the support bracket at spar 6 with the two bolts and washers; torque-tighten all four attachment bolts to between 40 and 45 lbf in (0.452 and 0.508 mdaN) and wire-lock the bolt heads in accordance with 20-21-13.

(k) Check that the pipe insertion dimension has not altered from the setting in operation (g).

(l) Reposition the bonding clips and connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

R (m) Apply ligatures and sealant, in accordance with
R 20-23-14, to secure the bonding leads as
R illustrated (Ref. Fig. 404).

R (n) Apply a brush-coating of sealant PR 1422BT to the
R bonding leads in areas of possible contact with
R knurled coupling nuts or flanges.

(8) Install the air intake door, panel 323 PR (Detail B), as follows:-

(a) Ensure that a new O-ring seal, lubricated in accordance with 20-23-11, is fitted to the groove at the forward end of pipe 1.

(b) Observing through panel 323 PL aperture, position the door with the sleeve connector over the forward end of pipe 1; check that the pipe insertion dimension in the sleeve is 0.2(±0.1) in (5.08(±2.54) mm).

(c) Using a torque screwdriver, secure the door to the fin skin with the eight countersunk bolts, torque-tightening each bolt to between 40 and

45 lbf in (0.452 and 0.508 mdaN).

(d) Connect the bonding leads to the door, in accordance with 20-27-11, using the countersunk bolt, washer and nut; torque-tighten the bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

G. Conclusion

(1) Check that all electrical bonding between the pipes and structure is in accordance with 20-27-11.

(2) Carry out a Leakage Test of the disturbed joints as detailed in 28-12-00, Adjustment/Test.

(3) Ensure that all tools, equipment, loose material etc., have been removed from the fin and remove the the debris-containment protection.

(4) Using a torque screwdriver, refit panel 323 PL, securing it to the fin skin with the eight countersunk bolts; torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(5) Refit all other access panels.

(6) If required, remove the air intake plug.

(7) Remove the placards from the fuel management and refuel control panel.

VENT AND PRESSURIZATION SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

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1. General

The system provides for venting and pressurization of the fuel tanks. The system has six connections to atmosphere, namely, a pressurization inlet in the fin, two normal inward and outward main vents in the rear tail cone, an overflow/relief valve under the rear fuselage and two inward relief valves mounted in front of tank 9.

This topic comprises Operational and System Tests and also various leakage test procedures. A Functional Test is not applicable.

The Operational and System Tests are divided, for convenience of application, into separate procedures within each test category, as follows:

A. Operational Test

(1) Scavenge Pump (including Trim Pipe Drain Valve).

(2) Overflow Relief Valve.

(3) Vent Shut-off Valve.

(4) Vent Inward Relief Valve

Checks the mechanical operation of the valve by its integral valve lifter.

B. System Test

(1) Scavenge Pump Control and Function

Checks the control of the scavenge pump by its sensor and RH level switching pack, and also the flow rate.

(2) Trim Pipe Drain Valves Function

Checks the mechanical operation of the valves and the fuel flow rate through them.

(3) Overflow Relief Valve Control

Checks control of the valve by each sensor and LH level switching pack, the interaction with the ground/flight relay (operated by the microswitch actuated by the refuel access panel door), the associated vent system overpressure and underpressure switches, and the fuel flow rate from the scavenge tank via the overflow relief valve.

(4) Vent Shut-off Valves Control

Checks control of the valves by their absolute pressure and overpressure switches.

(5) Tank Pressure Relief Valves Function

Checks the electrical signalling of the valves' float-operated reed switches.

(6) Vent System Pressure Switches Control and Function

Checks the control and function of all pressure switches (with their associated components) connected to the ambient sense pipe, i.e., the overflow relief valve and overpressure switches, the vent shut-off valves and overpressure switches, the tank pressure indicator pressure transducer and associated AMBER and TANK PRESS warnings, and the overflow relief valve and underpressure switch.

The Leakage Tests are as follows:

A. Leakage Test - Ambient Sense Pipeline

R
R
R
R B. Leakage Test - Tank Pressurization Pipe

R C. Leakage Test after Pipe Replacement in a Fuel Tank

R D. Leakage Test after Pipe Replacement in a Dry Bay

Checks pipelines from the rear of tanks 2 and 3, under the rear fuselage floor and at the rear of tank 11.

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2. Operational Test - Scavenge pump (including Trim Pipe Drain Valve)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Stopwatch	-
Container, 10 gal (45 l) capacity, for fuel spillage	-

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B. Prepare

(1) Ensure that all switches on the fuel management panel are at the normal ground settings (Ref. 28-00-00, Servicing) and the refuel control access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that tests are being carried out and the settings of the switches must not be altered.

(3) Position the container under the jettison outlet.

NOTE: This will collect a small amount of fuel that will spill when the jettison valves are opened.

(4) Trip the SCAVENGE PUMP CONT & IND circuit breaker Q493, on panel 15-216, map ref. C6, and fit a safety clip.

NOTE: This will inhibit operation of the scavenge pump when electrical power is first switched on.

C. Test

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) At the fuel management panel, check that the SCAVENGE PUMP indicator displays OFF.

(3) Reset the scavenge pump control circuit breaker and check that -

(a) the scavenge pump is heard to run,

(b) the indicator display changes to ON for at least 30(±2) s, then

(c) the scavenge pump stops and the indicator display changes to OFF.

(4) Ensure that the main trim transfer pipes contain fuel. If necessary:

(a) Set a LH and a RH, tank 9 or 10, trim transfer pump switch to "ON".

(b) Open both tank 11 main inlet valves for 10 s only. Set the switches to "SHUT". Wait until the associated indicator display changes to bar-across-line, then set the switches to "AUTO".

(c) Switch off the trim transfer pumps.

(5) Set both JETTISON MASTER VALVES switches to "OPEN".

(6) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The scavenge pump will run as fuel drains into the scavenge tank.

(7) Check that tank 3 fuel quantity indicator (FQI) shows an increase in contents as the scavenge pump runs.

(8) Set the TRIM PIPE DRAIN switch to "SHUT".

(9) Set the JETTISON MASTER VALVES switches to "SHUT". Wait until the indicator display changes to bar-across-line, then set the switches to "OFF".

D. Conclusion

(1) Remove the container from the jettison outlet.

(2) Remove the warning placards from the fuel management and refuel control panels.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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3. Operational Test - Overflow Relief Valve

A. Prepare

(1) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Attach a placard to the fuel management panel, warning that a test is being carried out and the settings of the switches must not be altered.

(3) Open the refuel control panel access door 194 JB.

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B. Test

(1) With electrical ground power off, check at the refuel control panel that the ORV TEST indicator displays diagonal stripes.

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check that the ORV TEST indicator displays SHUT.

CAUTION: ENSURE THAT THE SCAVENGE PUMP HAS STOPPED RUNNING BEFORE THE "ORV TEST" SWITCH IS OPERATED.

(4) Set and hold the ORV TEST switch at "TEST". Check that:

(a) the valve motor is heard to operate and

(b) the indicator display changes from SHUT, to diagonal stripes then to OPEN, within 2 s.

(5) Release the test switch. Check that:

(a) the valve motor is heard to operate and

(b) the indicator display changes from OPEN, to diagonal stripes then to SHUT, within 2 s.

C. Conclusion

(1) Ensure that the refuel master switch is at OFF/DEFUEL.

(2) Close the refuel control panel access panel door 194 JB.

(3) Remove the warning placard from the fuel management panel.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

4. Operational Test - Vent Shut-off Valve

A. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Open the refuel control panel access door 194 JB.

(3) Ensure that the refuel master switch is at OFF/DEFUEL.

(4) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) At the refuel control panel 1-194, check that the VENT VALVE NOT OPEN caption is not illuminated.

(2) Press and hold the FILAMENT TEST switch. Check that the NOT OPEN caption is illuminated.

NOTE: This test makes an open circuit in the vent valves normal indication circuit. The coil of the indication relay is normally energized when ground power is on, the refuel control panel access door is open and both vent valves are fully open.

(3) Release the test switch and check that the NOT OPEN caption is extinguished.

C. Conclusion

(1) Ensure that the refuel master switch is at OFF/DEFUEL and close the refuel control panel access door.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. Operational Test - Vent Inward Relief Valve

A. Prepare

R B (1) Open access panels 511BB and 611BB (Ref. 28-12-31 REMOVAL/
R B INSTALLATION) and remove access panels 511AZ and 611AZ
R B (secured by 16 bolts).

B. Test

(1) Remove the locking pin from the valve lifter.

(2) Push up on the valve lifter, until the 'open' reference mark on the valve lifter aligns with the 'reference face' on the bottom assembly. Check that the movement of the valve lifter is smooth and no excessive force is required to open the valve.

R (3) Release the valve lifter. Ensure that the valve
R is heard to close on its seating.

(4) Push the valve lifter up until the 'red spot' on the valve lifter is aligned with the reference face on the bottom assembly.

(5) Retain the valve lifter in this position by refitting the locking pin through the bottom assembly.

C. Conclusion

(1) Refit the access panels (Ref. 57-00-00, Removal/Installation).

6. System Test - Scavenge Pump Control and Function

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Container, 3 fl oz (85 ml), for testing sensor	-
Stopwatch	-
Drain tool	D925373000
Fuel test rig, for pumping 21 gal (Imp.) (95 l) of fuel into scavenge tank	-
Water drain valve adapter	E925126000
Container, 5 gal (Imp.) (22.5 l), for fuel drainage	-

B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that tests are being carried out and the settings of the switches must not be changed.

(3) Ensure that tank 3 can accept 20 gal (Imp.) (90 l) of fuel from the scavenge tank.

(4) Drain the scavenge tank and remove the water drain valve (Ref. 28-11-11, Removal/Installation).

(5) Remove the scavenge pump sensor from the scavenge tank (Ref. 28-12-54, Removal/Installation).

(6) Reconnect the scavenge pump sensor to its electrical connector.

C. Test

(1) Make available electrical ground power as detailed in 24-41-00.

NOTE: When electrical power is first switched on, the scavenge pump will run for 30(±2) s due to the 'warming up' of the sensor.

(2) Ensure that the small container has at least 1 in (25 mm) depth of clean fuel.

(3) Wait until the scavenge pump stops running, then immerse the sensor in the fuel in the container. Check that the scavenge pump operates immediately.

(4) Remove the sensor from the fuel. Check that the scavenge pump operation ceases after 30(±2) s. Note the time taken for the pump to stop after withdrawal of the sensor from the fuel.

(5) Refit the sensor to the scavenge tank (Ref. 28-12-54, Removal/Installation).

(6) Inhibit operation of the scavenge pump and overflow relief valve (ORV) by tripping the following circuit breakers and fitting safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15

(7) Using the water drain valve adapter, connect the fuel test rig to the scavenge tank at the water drain valve attachment.

(8) Pump 21 gal (Imp.) (95 l) of fuel into the scavenge tank and vent pipes.

(9) Reset the scavenge pump supply circuit breaker, then the scavenge pump control and indication circuit breaker. Check that the scavenge pump operates. The scavenge pump will run for approximately 115 s. Note the total running time of the pump, then -

(a) subtract the time noted in operation (4) from the total running time and

(b) check that the time remaining is between 80 and 90 s.

NOTE: This procedure checks the pump performance using 20 gal (Imp.) (90 l) of fuel. There is approximately 1 gal (Imp.) (4.5 l) of unpumpable fuel left in the scavenge tank.

D. Conclusion

(1) Position the container to collect fuel drained from the scavenge tank.

(2) Disconnect and remove the fuel test rig from the scavenge tank.

(3) Fit the water drain valve to the scavenge tank (Ref. 28-11-11, Removal/Installation).

(4) Reset the overflow relief valve circuit breaker.

(5) Remove the placards from the fuel management and refuel control panels.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(7) Refit all acccess panels that were removed to facilitate tests.

7. System Test - Trim Pipe Drain Valves Function

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Stopwatch	-
Container, 10 gal (Imp.) (45 l), for fuel spillage	-
Container, 30 gal (Imp.) (135 l) suitably calibrated to collect drained fuel	-
Bonding lead, from container to aircraft	-
Adapter, fuel overflow outlet	E925127000
Hose, 3 in (76.2 mm) ID, for use with overflow adapter	-

B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that tests are being carried

R out and the settings of the switches must not be
R altered.

R (3) Position the 30 gal (Imp.) (135 l) fuel container
R below the overflow relief valve (ORV) outlet. Bond
R the container to the aircraft.

R (4) Remove the bung from the overflow pipe adapter and
R fit the hose to the adapter.

R (5) Fit the overflow pipe adapter to the ORV outlet and
R position the hose in the container.

R (6) Open the refuel control panel access door 194 JB.

R (7) Make available electrical ground power as detailed
R in 24-41-00.

R (8) Wait until the scavenge pump stops running, then
R trip the SCAVENGE PUMP CONT & IND circuit breaker
R Q493, on panel 15-216, map ref.C6, and fit a safety
R clip.

R (9) Set the ORV to open as follows:-

R (a) At the refuel control panel, set and hold the
R ORV TEST switch to "TEST".

R (b) Check that the ORV indicator display changes
R from SHUT to diagonal stripes and then to OPEN.

R (c) With the ORV open, trip the OVERFLOW RELIEF
R VALVE SUP & IND circuit breaker Q721, on panel
R 1-213, map ref.K15, and fit a safety clip.

R (d) Release the ORV TEST switch from the TEST
R position. Check that the ORV does not close.

R (10) Position the 10 gal (Imp.) (45 l) fuel container under
R the fuel jettison outlet.

R (11) Ensure that the main trim transfer pipes contain fuel.
R If necessary -

R (a) set a LH and a RH, tank 9 or 10, trim transfer
R pump switch to "ON",

R (b) open both tank 11 main inlet valves for 10 s
R only,

R (c) set the switches to "SHUT", wait until the

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associated indicator display changes to bar-across-line, then set the switches to "AUTO", and

(d) switch off the trim transfer pumps.

C. Test

(1) Set both JETTISON MASTER VALVES switches to "OPEN". Ensure that the associated indicators display changes to bar-in-line.

(2) Set the TRIM PIPE DRAIN switch to "OPEN" for a period of 2 min. During this period check that -

(a) the magnetic indicators display changes from SHUT to diagonal stripes, then to OPEN, within 1 to 2 s of switch operation,

(b) the valves mechanical indicator moves to OPEN and

(c) fuel drains into the large container via the ORV outlet.

(3) At the end of the 2 min period, set the TRIM PIPE DRAIN switch to "SHUT". Check that -

(a) the indicator display changes from OPEN to diagonal stripes then to SHUT, within 1 to 2 s of switch operation,

(b) the valves mechanical indicator moves to SHUT and

(c) the quantity of fuel drained into the container
R is not less than 12 gal (Imp.) (54.5 l).

(4) Set the JETTISON MASTER VALVES switches to "SHUT". Wait until the indicator display changes to bar-across-line, then set the switches to "OFF".

D. Conclusion

(1) Reset the scavenge pump and overflow relief valve circuit breakers. Ensure that the ORV closes.

(2) Remove the bonding lead and remove both fuel containers.

(3) Remove the overflow pipe adapter.

(4) Remove the placards from the fuel management and refuel control panels.

(5) Close the refuel control panel access door.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(7) Refit any access panels that were removed for access to components.

8. System Test - Overflow Relief Valve Control

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Air pressure/vacuum test rig, for operating overpressure and underpressure switches	-
Container, 3 fl. oz (85 ml), R for testing sensors	-
Container, 5 gal (Imp.) (22.5 l) R for fuel drainage	-
Container, 30 gal (Imp) (135 l), suitably calibrated to collect drained fuel	-
Bonding lead, from large container to aircraft	-
Fuel test rig, for pumping 21 gal (Imp.) (95 l) of fuel into scavenge tank	-
Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN)	-
Adapter, water drain valve	E925126000

DESCRIPTION	PART NO.
Drain tool	D925373000
Adapter, fuel overflow outlet	E925127000
Hose, 3 in (76.2 mm) ID, for use with overflow adapter	-

B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing), and the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panel, warning that tests are being carried out and the settings of the switches must not be altered.

(3) Position the 30 gal (Imp.) (135 l) container under the overflow relief valve (ORV) outlet. Bond the container to the aircraft.

(4) Remove the bung from the overflow pipe adapter and fit the hose to the adapter.

(5) Fit the overflow pipe adapter to the ORV outlet and position the hose in the container.

(6) Drain the scavenge tank and remove the water drain valve (Ref. 28-11-11, Removal/Installation).

(7) Using the water drain valve adapter, connect the fuel test rig to the scavenge tank at the water drain attachment.

(8) Remove the ORV sensors from the scavenge tank (Ref. 28-12-54, Removal/Installation).

(9) Reconnect the ORV sensors to their electrical connectors.

(10) Trip the SCAVENGE PUMP CONT & IND circuit breaker

R Q493, on panel 15-216, map ref.C6, and fit a safety clip.

R (11) Make available electrical ground power as detailed in 24-41-00. Check that the scavenge pump does not run.

R (12) Open the refuel control access panel 194 JB. Ensure that the refuel master switch is at OFF/DEFUEL.

R C. Test

R (1) To ensure that the ORV sensors elements are 'cool', trip the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721, on panel 1-213, map ref.K15, and leave tripped for at least 2 min.

R (2) Ensure that the small container has at least 1 in (25 mm) depth of clean fuel.

R (3) Immerse one of the sensors in the fuel in the small container.

R (4) Reset the overflow relief valve supply circuit breaker. Check that -

R (a) the ORV opens after a time delay of 35 to 45 s and

R (b) the mechanical indicator on the ORV is at O.

R (5) Remove the sensor from the fuel. Check that -

R (a) the ORV closes after a time delay of 30 to 34 s and

R (b) the mechanical indicator on the ORV is at S.

R (6) Again immerse the sensor in the fuel. Check that the ORV opens within 2 s. Remove the sensor from the fuel.

R (7) Close the refuel control access panel door.

R (8) Immerse the other sensor in the fuel in the small container. Check that the ORV remains closed.

R (9) Open the refuel control access panel. Check that the ORV opens within 2 s.

R (10) Remove the sensor from the fuel. Check that the

ORV closes after 30 to 34 s.

NOTE: The sensor and test fuel should be retained for a further test.

(11) At the vent system overpressure pressure switches (Ref. 28-12-33), connect the air pressure/vacuum test rig to the ambient sense side of one of the two overpressure switches.

(12) Disconnect the electrical connector from the overpressure switch not under test.

(13) Slowly reduce air pressure at the switch. Check that the ORV opens at a negative pressure of between 2.8 and 3 psig (0.193 and 0.206 bar).

(14) Slowly release the negative pressure. Check that the ORV closes when the negative pressure decreases to between 2.5 and 2 psig (0.172 and 0.137 bar).

(15) Close the refuel control access panel.

(16) Repeat operation (13). With the ORV open, immerse the sensor in the container of fuel.

(17) Release the negative pressure from the overpressure switch. Check that the ORV remains open.

(18) Remove the ORV sensor from the fuel. Check that the ORV closes after a time delay of 30 to 34 s.

(19) Refit the ORV sensors to the scavenge tank (Ref. 28-12-54, Removal/Installation).

(20) Disconnect the test rig from the overpressure switch, also disconnect the electrical connector from this pressure switch.

(21) Connect the test rig to the ambient sense side of the other overpressure switch and reconnect its electrical connector.

(22) Repeat operations (13) and (14).

(23) Disconnect the test rig from the overpressure switch, and reconnect the electrical connector on the other overpressure switch.

(24) Reconnect the ambient sense pipes to the overpressure switches. Torque-tighten the union nuts to between

R 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance
R with 20-23-12.

R (25) Connect the test rig to the ambient sense side of
R the underpressure switch (Ref. 28-12-55).

R (26) Slowly apply pressure. Check that the ORV opens
R when pressure is between 1.4 and 1.5 psig (0.096
R and 0.103 bar).

R (27) Slowly release pressure. Check that ORV closes when
R pressure drops to 0.70 psig (0.048 bar).

R (28) Disconnect and remove the test rig from the under-
R pressure switch.

R (29) Reconnect the ambient sense pipe to the underpressure
R switch. Torque-tighten the union nut to between
R 40 and 65 lbf in (0.45 and 0.73 mdaN).

R <u>NOTE</u>: The refuel control access panel must be left closed,
R as this will inhibit operation of the ORV via
R its level sensors when fuel is being pumped into
R the scavenge tank.

R (30) Using the fuel test rig, pump 21 gal (Imp.) (95 l)
R of fuel into the scavenge tank and vent pipes.

R (31) Check over a period of 10 min that there are no
R fuel leaks from the scavenge tank and pump, and the
R ORV and associated piping.

R (32) Open the refuel control access panel. Check that -

R (a) the ORV opens within 2 s, and

R (b) at least 20 gal (Imp.) (90 l) of fuel is dumped
R via the ORV into the container in not more than
R 30 s.

R <u>NOTE</u>: The ORV will close approximately 30 to 34 s
R after the sensors are uncovered by the fuel.

R D. Conclusion

R (1) Position the 5 gal (Imp.) (22.5 l) container to
R collect fuel drained from the scavenge tank.

R (2) Disconnect and remove the fuel test rig from the
R scavenge tank.

R (3) Fit the water drain valve to the scavenge tank (Ref. 28-11-11, Removal/Installation).

R (4) Reset the scavenge pump circuit breaker.

R (5) Remove the fuel draining containers and bonding lead.

R (6) Remove the overflow pipe adapter from the ORV outlet.

R (7) Close the refuel control panel access door.

R (8) Remove the placards from the fuel management and refuel control panels.

R (9) Switch off and disconnect electrical ground power, as detailed in 24-41-00.

R (10) Ensure that all access panels that were removed to facilitate testing are refitted.

R 9. <u>System Test - Vent Shut-off Valves Control</u>

R A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Air pressure/vacuum test rig, for operating vent overpressure and vent absolute pressure switches	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Shorting link, for absolute pressure switch electrical connector	-
Stopwatch	-

R B. Prepare

R (1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing), and the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panel, warning that tests are being carried out and the settings of the switches must not be altered.

(3) Ensure that the tail landing gear is lowered, so that components are accessible.

(4) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

(5) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(6) Make available electrical ground power as detailed in 24-41-00.

(7) Open the refuel control panel access door 194 JB; check that the vent valve NOT OPEN caption is not illuminated.

(8) At the vent shut-off valves (Ref. 28-12-51), check that the visual indicators are at OPEN.

(9) At the vent absolute pressure switches (Ref. 28-12-57), connect the air pressure/vacuum test rig to the LH pressure switch.

C. Test

(1) Slowly reduce air pressure at the switch. When the absolute pressure is between 2.65 and 2.05 psia (0.180 and 0.1386 bar), at the LH vent valve, check that -

(a) the valve closes in not more than 15 s,

R (b) the visual indicator is at SHUT and

R (c) the VENT VALVE NOT OPEN caption is illuminated.

R (2) Slowly release the negative pressure. When the absolute pressure is between 2.05 and 2.65 psia (0.1386 and 0.180 bar), at the LH vent valve check that -

R (a) the valve opens in not more than 15 s,

R (b) the visual indicator is at OPEN and

R (c) the vent valve NOT OPEN caption is extinguished.

R (3) Connect the test rig to the RH absolute pressure switch.

R (4) Repeat operations (1) and (2), but applied to the RH vent valve.

R (5) To test the vent overpressure switch (Shut-off Valve; Ref. 28-12-56), it is necessary that the vent shut-off valves are in the closed position. Either -

R (a) use a pressure/vacuum test rig at the absolute pressure switch, as detailed in operation (1) to maintain the vent valve closed, or

R (b) disconnect the electrical connector at the absolute pressure switch and fit a shorting link to the free connector, pins A-B. Ensure that the vent valve closes.

R (6) Connect the pressure/vacuum test rig to the ambient sense side of the LH vent overpressure switch.

R (7) With the vent valve closed as detailed in operation (5) and the NOT OPEN caption illuminated; slowly reduce air pressure at the switch. When the negative pressure is between 3.55 and 3.75 psig (0.245 and 0.258 bar), at the LH valve check that -

R (a) the valve opens in not more than 15 s,

R (b) the visual indicator is at OPEN and

R (c) the vent valve NOT OPEN caption is extinguished.

R (8) Slowly release the negative pressure. When the negative pressure has reached 2.75 psig (0.189 bar),

R at the LH valve check that -

R (a) the valve closes in not more than 15 s,

R (b) the visual indicator is at SHUT and

R (c) the vent valve NOT OPEN caption is illuminated.

R (9) Connect the pressure/vacuum test rig to the ambient sense side of the RH vent overpressure switch.

R (10) Repeat operations (5), (7) and (8) but applied to the RH vent valve.

R D. Conclusion

R (1) Remove the pressure/vacuum test rig.

R (2) If a shorting link was used in the electrical connector for the absolute pressure switch, remove it and reconnect the electrical connector to the absolute pressure switche(s), ensuring that the mating surfaces are clean and undamaged.

R (3) Reconnect the ambient sense pipes to the overpressure switches.

R (4) Reconnect the absolute pressure switch sense pipes to the switches.

R (5) Torque-tighten the sense pipe union nuts to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

R (6) Wire-lock the pipe union nuts with 0.036 in (0.91 mm) dia. locking wire (DTD 189) in accordance with 20-21-13.

R (7) Remove the locking sleeve from the tail landing gear.

R (8) Reset the landing gear (undercarriage) circuit breakers previously tripped.

R (9) Remove the warning placards from the fuel management and refuel control panel.

R (10) Close the refuel control panel access door.

R (11) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 10. <u>System Test - Tank Pressure Relief Valves Function</u>

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing)and that the refuel control access panel is closed.

(3) Attach placards to the fuel management and refuel control panels, warning that tests are being carried out and the settings of the switches must not be altered.

(4) Ensure that the fuel level in tanks 5, 5A, 6, 7, 7A, 8, 9 and 10 is below 90 per cent full. If necessary, transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing).

B. Test

(1) At the refuel control panel, ensure that the TPRV selector switch is turned fully counter-clockwise to NORMAL.

(2) Set the refuel master switch to "SET UP".

(3) Check that the PRV caption is illuminated, indicating that all 16 valves are open.

(4) Press the TPRV EARTH TEST switch; check that the PRV caption is extinguished. Release the TEST switch; check that the PRV caption is illuminated.

(5) Refuel tanks 5, 5A, 6, 7, 7A, 8, 9, and 10 to high level (Ref. 12-11-28). Check that the PRV caption is extinguished.

(6) Set the TPRV selector switch to each position in turn. Check that the PRV caption is not illuminated.

(7) Reset the TPRV selector switch counter-clockwise to "NORMAL". Check that the PRV caption remains extinguished.

C. Conclusion

(1) Remove the warning placards.

R (2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 11. System Test - Vent System Pressure Switches Control and Function

R **NOTE:** This test checks the operation of pressure switches associated with the vent system ambient sense pipe.

R Should any pressure switch fail to operate within its nominal tolerance, a System Test of the particular component concerned must be carried out before rectification action.

R With the exception of the tank pressure indication transducer (Ref. 28-46-00, Adjustment/Test), System Tests of components associated with vent system pressure switches are detailed in this procedure.

R Should a leak be suspected during this test, the ambient sense line drain valve (Ref. 28-12-62, Adjustment/Test) must be checked before a leakage test, as detailed in this topic, is carried out.

R A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Stopwatch	-
Air pressure/vacuum test rigs (2), for use on ambient sense pipeline and absolute pressure switches	-
Plug adapters (2), for ambient sense pipe vents	E925054000
Rubber bung (conical), for ambient sense pipe drain valve (approximately 1 in (25.4 mm) long, tapering from 0.25 in (6.35 mm) dia. to 0.45 in (11.4 mm) dia.)	-
Container, 30 gal (Imp.) (135 l), for collecting drained fuel	-
Bonding lead, from container to	-

DESCRIPTION	PART NO.
aircraft	
Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN)	-

B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing), and the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panel door, warning that tests are being carried out and the settings of the switches must not be altered.

(3) Position the fuel container under the overflow relief valve (ORV) outlet. Bond the container to the aircraft with the bonding lead.

(4) Disconnect the electrical connector at the forward vent overpressure switch (Ref. 28-12-33).

(5) Blank the ambient sense pipe vent at the LH side of tank 11 with a plug adapter.

(6) Fit the other plug adapter to the ambient sense pipe vent at the RH side of tank 11. Connect a pressure/vacuum test rig to this adapter.

(7) Check that the ambient sense pipe drain valve (Ref. 28-12-62) is closed.

(8) Ensure that the tail landing gear is lowered, so that the vent shut-off valves are accessible.

(9) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

(10) Fit a locking sleeve to the tail landing gear, jack (Ref. 12-37-00, Tail Gear Wheel).

(11) Remove the access panel 153 BB, to gain access to the ORV.

(12) Make available electrical ground power as detailed in 24-41-00.

(13) At panel 15-214 (Ref. 28-46-00), ensure that the tank pressure indicator main pointer and secondary pointers are at zero. If necessary, on panel 23-214, operate the LIMIT RESET switch to 'zero' the secondary pointers.

C. Test

(1) Connect an air pressure/vacuum test rig to the two vent absolute pressure switches (Ref. 28-12-57).

(2) Slowly reduce air pressure at the switches to 2 psia (0.1379 bar). When the absolute pressure is between 2.65 and 2.05 psia (0.180 and 0.1386 bar), check that -

(a) both vent shut-off valves close in not more than 15 s and

(b) their visual indicators are at SHUT.

(3) Keep both vent shut-off valves in the closed position with the test rig.

(4) At the test rig connected to the ambient sense pipes, slowly reduce pressure to -3 psig (0.206 bar).

(5) As pressure decreases, check that at a negative pressure of between -2.8 and -3 psig (-0.193 and

R -0.206 bar) the ORV opens within 2 s.

R (6) Slowly release the negative pressure. Check that at a negative pressure of between -2.5 and -2 psig (-0.172 and -0.137 bar), the ORV closes within 2 s.

R (7) Disconnect the electrical connector from the rear vent overpressure switch and reconnect the electrical connector to the forward vent overpressure switch (Ref. 28-12-33).

R (8) Repeat operations (4), (5) and (6).

R (9) Reconnect the electrical connector to the rear vent overpressure switch.

R (10) At the test rig connected to the ambient sense line, slowly reduce pressure to -3.8 psig (-0.262 bar).

R (11) As pressure decreases, check that at a negative pressure of between -3.73 and -3.75 psig (-0.245 and -0.258 bar), both vent shut-off valves open in not more than 15 s.

R (12) Slowly release the negative pressure. Check that when the negative pressure reaches -2.75 psig (-0.189 bar), both vent shut-off valve close in not more than 15 s.

R (13) At the test rig, slowly reduce pressure to -5 psig (0.344 bar).

R NOTE: The ambient sense pipe drain valve may start to admit air into the sense piping at a negative pressure of approximately -5 psig (-0.344 bar) (or less if the drain valve seating is dirty). If necessary, a conical rubber bung should be fitted in the drain valve outlet.

R (14) As pressure decreases, check that at a negative pressure of between -3.87 and -4.13 psig (-0.266 and -0.284 bar) -

R (a) at panel 15-214 (Ref. 28-46-00), the TANK PRESS caption is illuminated,

R (b) the AMBER fuel caption on the master warning panel is illuminated,

R (c) the audio warning (single-stroke gong) sounds

and

(d) the tank pressure indicator main pointer (and secondary pointer) is at plus 4(±0.1) psi.

(15) Slowly release the negative pressure. Check that at a negative pressure of between -4.13 and -3.87 psig (0.284 and 0.266 bar) -

(a) the TANK PRESS caption is extinguished and

(b) the AMBER fuel caption on the master warning panel is extinguished.

(16) When pressure is at 0 psig (0 bar), check that the tank pressure indicator secondary pointer has 'latched' at 5 psi and the main pointer has returned to zero.

<u>CAUTION:</u> TO PREVENT DAMAGE TO THE TANK PRESSURE INDICATION TRANSDUCER, DO NOT PRESSURIZE THE AMBIENT SENSE PIPES ABOVE 3 psig (0.207 bar).

(17) At the test rig, slowly increase air pressure to 1.6 psig (0.110 bar).

(18) As pressure increases to between 1.4 and 1.5 psig (0.096 and 0.103 bar), check that the ORV opens within 2 s.

(19) Slowly release air pressure. Check that the ORV closes when pressure drops to 0.70 psig (0.048 bar).

(20) At the test rig, slowly increase air pressure to 2 psig (0.138 bar).

(21) As pressure increases to between 1.67 and 1.83 psig (0.146 and 0.157 bar), check that -

(a) at panel 15-214, the TANK PRESS caption is illuminated,

(b) the AMBER fuel caption on the master warning panel is illuminated,

(c) the audio warning (single-stroke gong) sounds and

(d) the tank pressure indicator main pointer (and secondary pointer) is at -1.73(±0.1) psi.

R (22) At the test rig slowly release air pressure.

R (23) As pressure decreases to between 1.83 and 1.67 psig
R (0.157 and 0.146 bar), check that -

R (a) the TANK PRESS caption is extinguished and

R (b) the AMBER fuel caption on the master warning
R panel is extinguished.

R (24) When pressure is at 0 psig (0 bar), check that the
R tank pressure indicator secondary pointer has
R 'latched' at -2 psi and the main pointer has returned
R to zero.

R (25) At panel 23-214 (Ref. 28-46-00), press the LIMIT
R RESET push-switch. Check that both tank pressure
R indicator secondary pointers return to the zero
R position.

R (26) At the test rig connected to the two vent absolute
R pressure switches, release the negative air
R pressure and check that both vent shut-off valves
R open.

R D. Conclusion

R (1) Remove the test rig from the vent absolute pressure
R switches.

R (2) Reconnect the absolute pressure switch sense pipes
R to the switches. Torque-tighten the sense pipe
R union nuts to between 40 and 65 lbf in (0.45 and 0.73
R mdaN).

R (3) Wire-lock the pipe union nuts with 0.036 in (0.91 mm)
R dia. locking wire (DTD 189) in accordance with
R 20-21-13.

R (4) Remove the container and bonding lead from the ORV
R outlet.

R (5) Remove the plug adapters and test rig from the
R ambient sense pipe vents.

R (6) If fitted, remove the rubber bung from the ambient
R sense pipe drain valve.

R (7) Remove the locking sleeve from the tail landing
R gear.

(8) Reset the landing gear (undercarriage) circuit breakers previously tripped.

(9) Refit any access panels that were removed.

(10) Remove the placards from the fuel management and refuel control panels.

(11) Switch off and disconnect electrical ground power as detailed in 24-41-00.

12. Leakage Test - Ambient Sense Pipeline (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Air pressure test rig, to pressurize ambient sense pipeline to 5 psig (0.345 bar)	-
Plug adapters (2), for ambient sense pipeline vents	E925054000
Pressure blank, for ambient pipeline	AN806 6D
Torque spanner, 75 to 85 lbf in (0.847 to 1.412 mdaN)	-
Torque spanner, 145 to 155 lbf in (1.186 to 1.299 mdaN)	-

B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that tests are being carried out and the settings of the switches must not be altered.

(3) Inhibit operation of the overflow relief valve, by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721, on panel 1-213, map ref.K15, and fit a safety clip.

(4) Blank off the ambient sense pipe vent, at the LH side of tank 11, with a plug adapter.

(5) Fit the other plug adapter to the ambient sense vent at the RH side of tank 11. Connect the pressure test rig to this adapter.

(6) Disconnect the ambient sense pipe from the pressure transmitter (Ref. 28-46-21) and fit and tighten the pressure blank to the sense pipe union nut.

(7) Ensure that the ambient sense pipe drain valve (Ref. 28-12-62) is closed.

C. Test

(1) Using the pressure test rig, pressurize the ambient sense pipeline to 5 psig (0.345 bar).

(2) Check that there is no loss of pressure, over a period of 10 min.

(3) If a leak is indicated, proceed as follows:-

(a) Remove all access panels associated with the pipeline joints.

(b) Using the test rig, maintain a pressure of 5 psig (0.345 bar) in the pipeline.

(c) Using a soap solution, as detailed in 20-23-12, check all pipe joints and pipe-to-component connections for freedom from leakage.

(d) Where a leak is detected, check-tighten the pipe joint/connection to the torque value specified in 20-23-12, and re-test for leaks.

(e) If the check-tightening does not stop the leak, remake and/or renew the joint connection.

(f) Leak-test the remade/renewed joints/connections for leaks as detailed in operations (1) and (2).

D. Conclusion

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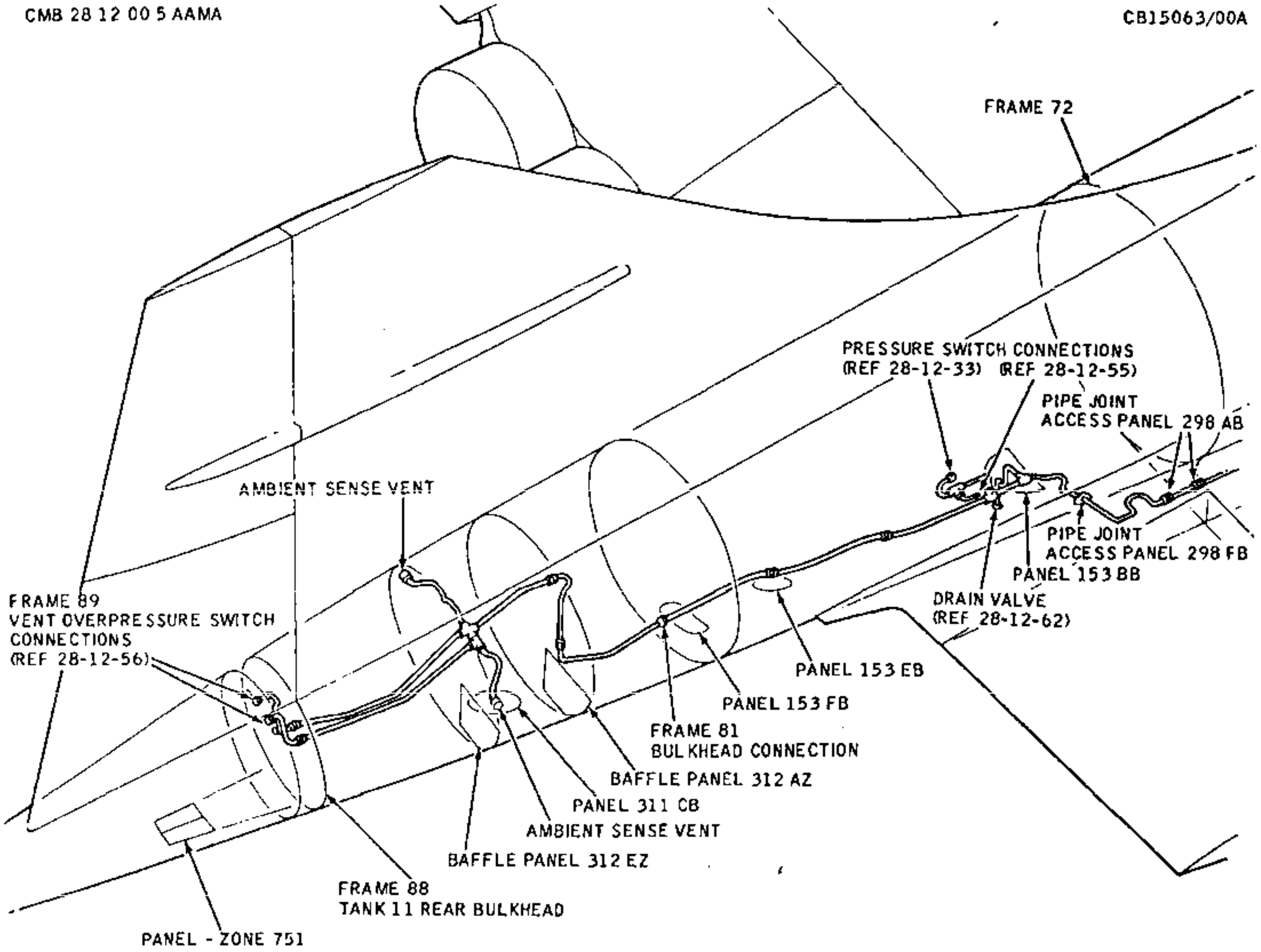

R - Ambient Pipeline Installation (Sheet 1 of 2)
Figure 501

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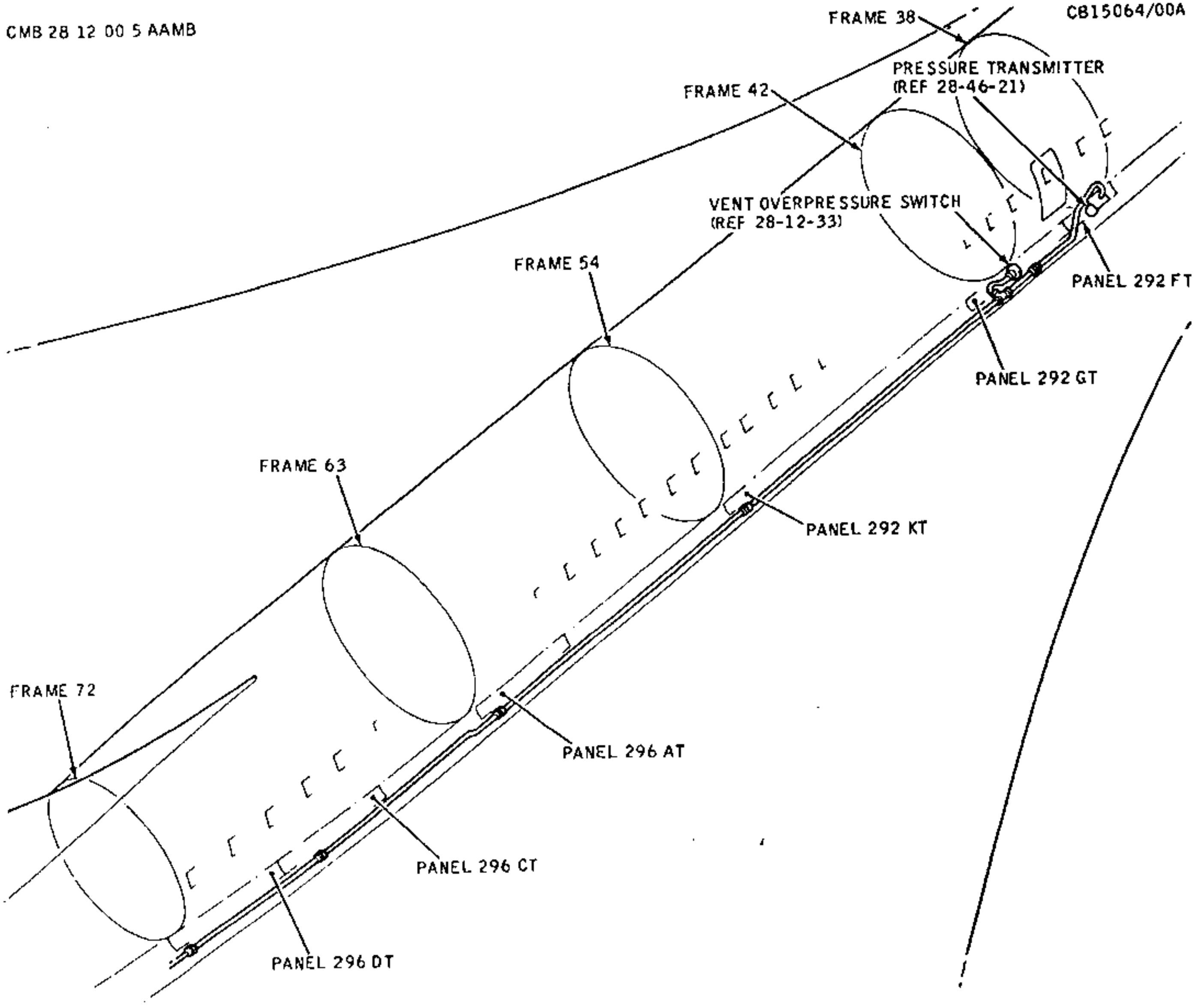

R - Ambient Pipeline Installation (Sheet 2 of 2)
Figure 501

(1) Wire-lock, as required, all pipe joints/connections that have been disturbed (Ref. 20-21-13).

(2) Remove the pressure blank from the ambient sense pipe and reconnect the pipe to the pressure switch (Ref. 28-46-21, Removal/Installation).

(3) Remove the pressure test rig and plug adapters from the ambient sense pipe vents.

(4) Remove the safety clip and reset the overflow relief valve circuit breaker.

(5) Refit the access panels that were removed (Ref. 53-00-00 and 57-00-00, Removal/Installation).

(6) Remove the warning placards from the fuel management and refuel control panels.

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13. Leakage Test - Main and Secondary Vent Galleries

R Test deleted.

R 14. Leakage Test - Tank Pressurization Pipe (Ref. Fig.502)

NOTE: To reduce the amount of air required for pressurization, the tanks should be as full of fuel as is practicable. Refuel, as required (Ref. 12-11-28).

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a pressure of 10 psig (0.690 bar)	-
Fuel manometer, to release pressure above 2 psig (0.138 bar)	-
Flow test adapter blank	E925049000
Air intake plug	E935055000
Soap solution	
Recommended:	
TURCO BUBBLE FLUID	-

DESCRIPTION	PART NO.
Approved alternatives:	
SNOOP (Ref. 20-30-00, No.195)	-
SHERLOCK (Ref. 20-30-00, No.196)	-
Brush, for application of soap solution	-

B. Prepare

(1) Ensure that all fuel tank panels are fitted.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the position of the switches must not be altered.

(3) Remove the appropriate access panels (Ref. Fig.502).

(4) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(5) Ensure that the vent shut-off valves are open (Ref. 28-12-51, Adjustment/Test).

(6) Remove the six countersunk bolts and nuts from the skin surrounding the vent outlets.

(7) Secure the flow test adapter blank to the vent outlet with the bolts and nuts supplied.

(8) Fit blanks to one adapter outlet pipe and nipple.

(9) Connect an air supply rig and a manometer to the other adapter outlet pipe.

(10) Set the manometer to release the pressure at 2 psig (0.138 bar).

(11) Fit the air intake plug to the air intake scoop.

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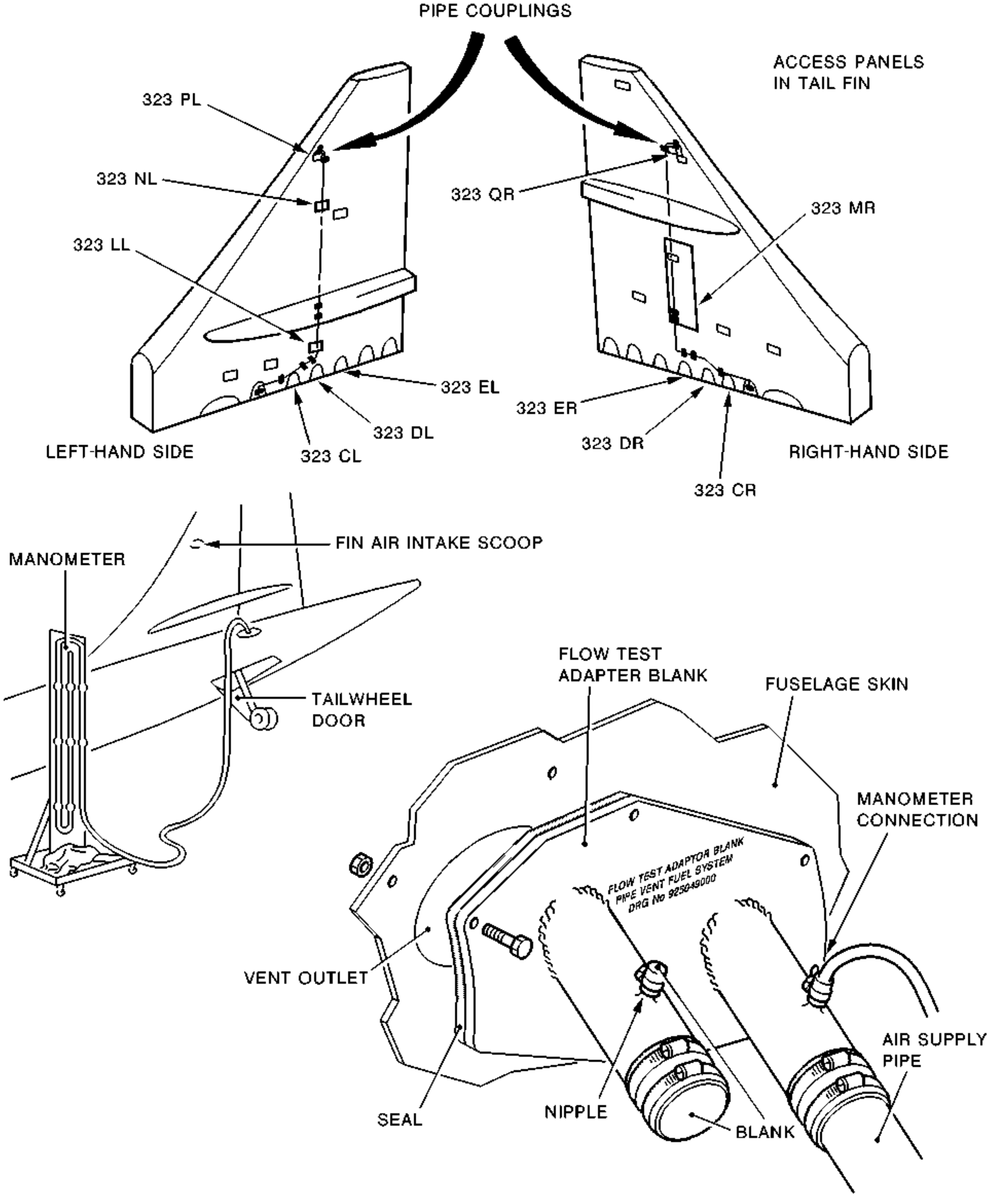

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Tank Pressurizing Pipe - Leakage Test
Figure 502

C. Test

(1) Pressurize the vent system to 2 psig (0.138 bar). Maintain this pressure for 10 min.

(2) During the 10 min period, apply the soap solution to all pipe joints to check for freedom from leaks.

(3) Slowly release the air pressure.

D. Conclusion

(1) Using a sponge and clean fresh water, clean off the soap solution.

(2) Refit the access panels previously removed.

(3) Remove the plug from the air intake scoop.

(4) Remove the test rig, manometer and flow test adapter blank.

(5) Refit the six countersunk bolts and nuts to the surround of the vent outlets. Torque-tighten the nuts to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(6) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(7) Remove the warning placards.

R 15. Leakage Test - After Pipe Replacement in Fuel Tank

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Container, 10 gal (Imp.) (45 l), for fuel draining	-
Drain tool	D925373000

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B. Prepare

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that tests are being carried out and that the settings of the switches must not be altered.

(3) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q 721	K15
SCAVENGE PUMP SUP	14-216	Q 491	E 4
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

(4) Using the drain tool, drain the scavenge tank, via its water drain valve (Ref. 28-11-11), into the container.

(5) Remove the scavenge tank water drain valve (Ref. 28-11-11, Removal/Installation).

(6) Discard any fuel in the container and position the container under the scavenge tank.

C. Test

R (1) Refuel to full capacity the tank containing the pipe(s) under test (Ref. 12-11-28).

(2) Check that there is no drainage of fuel into the container over a period of 2 h.

D. Conclusion

(1) Refit the water drain valve to the scavenge tank (Ref. 28-11-11, Removal/Installation).

(2) Remove the safety clips and reset the circuit breakers previously tripped.

(3) Remove the container and remove the warning placards.

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R 16. Leakage Test - after Pipe Replacement in Dry Bays

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Container, 50 gal (Imp.) (227 l), for fuel spillage	-
Bonding lead, for container to aircraft	-
Air pressure/vacuum test rig, for operating vent absolute pressure switches	-
or	
Shorting links for absolute pressure switch electrical connectors	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(3) Ensure that there is sufficient fuel in tank 2, i.e., at least 1,000 kg, and spare capacity in tank 3 to receive up to 500 kg of fuel after these tests. If necessary, refuel (Ref. 12-11-28) or defuel the aircraft (Ref. 28-25-00, Servicing).

(4) Attach placards to the fuel management and refuel control panel, warning that tests are being carried out and that the settings of the switches must not be altered.

(5) Ensure that access panels 197/198 - DB, EB, FB, GB and 153 - AB, EB and FB are removed as required.

(6) Ensure that the tail landing gear is lowered with the associated access doors, Zones 753 and 754, open.

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(7) Trip the following circuit breakers and fit safety clips:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q 721	K15
SCAVENGE PUMP SUP	14-216	Q 491	E 4
UC RAISE DOORS CLOSE SUP	15-215	G 1	A 6
UC LOWER DOORS OPEN SUP		G 3	A 8
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

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(8) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(9) Close the vent shut-off valves as detailed under para. (a) or (b), as appropriate.

(a) If using the air pressure/vacuum test rig, proceed as follows:

a1) Connect the air pressure/vacuum test rig to the vent absolute pressure switches (Ref. 28-12-57, Removal/Installation).

a2) Slowly reduce air pressure at the switches and ensure that the vent shut-off valves close when pressure is reduced to between 2.65 and 2.05 psia (0.180 and 0.1386 bar).

a3) Keep the vent valves closed by tripping the following circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH VENT VALVE SUP	1-213	Q 722	K16
RH VENT VALVE SUP	3-213	Q 723	D 7

a4) Remove the air pressure/vacuum test rig from the absolute pressure switches.

a5) Reconnect the absolute pressure switch sense pipes to the switches. Torque-tighten the union nuts to between 40 and 65 lbf in (0.452 and 0.734 mdaN). Wire-lock the union nuts (Ref. 20-21-13).

(b) If using the shorting link, proceed as follows:

b1) Disconnect the electrical connector at each absolute pressure switch (Ref. 28-12-57, Removal/Installation).

b2) Fit a shorting link to each free connector pins A-B. Ensure that the valves close.

b3) Trip the vent valve circuit breakers and fit safety clips (Ref. para.a3)).

b4) Remove the shorting link from each pressure switch electrical connector.

b5) Reconnect the electrical connectors to the absolute pressure switches, ensuring that the mating surfaces are clean and undamaged.

(10) Position the container under the vent system outlets in the tail cone. Electrically bond the container to the aircraft with the bonding lead.

NOTE: The container will collect a limited amount of fuel spillage from the vent system (via the pressure control valve), when fuel is transferred into the vent piping.

C. Test

(1) Transfer 200 kg of fuel into the vent system as follows:

(a) At the fuel management panel, set the TRIM PIPE DRAIN switch at "OPEN". Check that the indicators display OPEN.

(b) Set tank 2 JETTISON switch to "OPEN". Check that the indicator displays bar-in-line.

(c) Set a tank 2 standby ENGINE FEED PUMP (Ref. 28-21-00) switch to "ON". Check that the associated LOW PRESS caption is extinguished.

(d) Monitor the tank 2 FQI.

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(2) When fuel has transferred, set:

(a) the standby ENGINE FEED PUMP switch to "OFF",

(b) the TRIM PIPE DRAIN switch to "SHUT" and

(c) the tank 2 JETTISON switch to "SHUT".

(3) Check that there is no leakage of fuel from the replaced pipes/couplings, over a period of 1 h.

D. Conclusion

(1) Reset the scavenge pump circuit breakers and allow the scavenge pump to empty the vent system.

(2) While the scavenge pump is still operating, reset the LH and RH vent valve supply circuit breakers. Ensure that the vent valves open.

(3) If the shorting link was used to shut the vent shut-off valves, prove the integrity of the reconnected absolute pressure switches (Ref. 28-12-57, Adjustment/Test).

(4) Remove the locking sleeve from the tail landing gear jack.

(5) Fit the access panels (Ref. 53-00-00, Removal/Installation).

(6) Reset the landing gear (undercarriage) and overflow relief valve circuit breakers.

(7) Remove the warning placards.

(8) Remove the container and bonding cable.

(9) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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VENT AND PRESSURIZATION SYSTEM - APPROVED REPAIRS

1. General

Four repair schemes contained in this topic apply to the light-alloy pipes in the tail cone, aft of frame 88.

These four schemes apply to straight and curved pipes, and are included under the following headings:-

Simple Crack (Pipe or Flange)

Multiple Cracks

Pipe and Support Ring Crack

Support Ring Crack

There is no limitation to the number or type of the above repairs for a given length or area of pipe.

A fifth repair scheme (Ref. para.6.) is provided for a temporary repair of the fin-mounted fuel pressurizing pipe and requires the manufacture of a joint piece. After SB 28-032 this scheme is not applicable.

2. Simple Crack (Pipe or Flange) (Ref. Fig. 801)

CAUTION: THIS REPAIR MUST NOT BE CARRIED OUT WITH THE PIPE INSTALLED IN THE AIRCRAFT.

R B NOTE: When manufacturing new pipes, L.56 is an
R B approved alternative for AG.3 material.

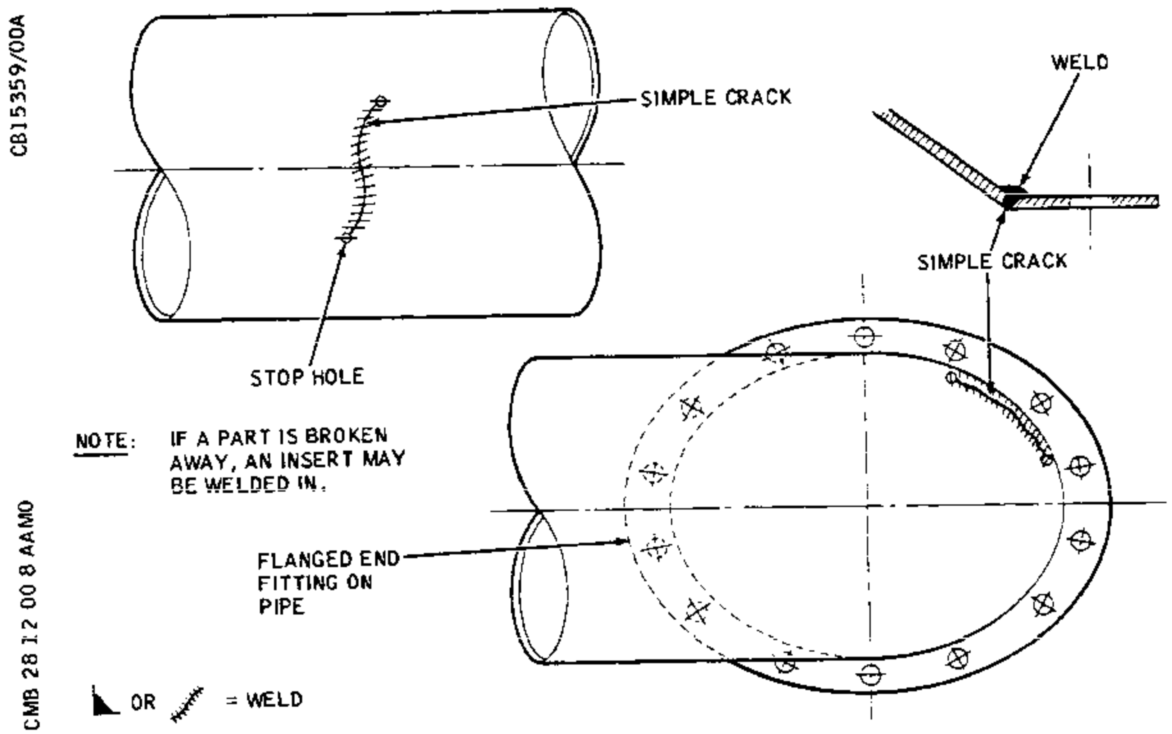
A. Equipment and Materials

DESCRIPTION	PART NO.
Radiographic flaw-detection equipment	-
Penetrant, for crack detection	-
Argon Arc welding equipment	-
Filler rods (Ref. Table 801)	-
Suitable blanks for pipe ends, with one blank adapted for connection of a kerosine pressure supply	-

DESCRIPTION	PART NO.
Clean kerosine	-
Pump, capable of pressurizing kerosine to 15 psig (1.035 bar)	-
Kimwipe tissues, or clean lint-free cloth	-

B. Prepare to Repair Simple Crack

(1) Remove the pipe from the aircraft.



Simple Crack - Repair
Figure 801

C. Repair Simple Crack

(1) Remove the protective treatment from the affected

area.

(2) Determine the extent of the crack, using radiographic equipment or penetrant. If penetrant is used, thoroughly clean the crack before welding.

(3) Drill a stop hole, 0.125 in (3.20 mm) dia., at each extremity of the crack.

(4) Weld the crack, filling the stop holes, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.

D. Conclusion

(1) Check the serviceability of the weld by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

PIPE PART NO.	PIPE MATERIAL	FILLER ROD
E746173003, E746274003, E746176001, E746177001, E746178003, E746248001	L59	) BS 1453 or) BS 2901/G1,) G1A, G1B, G1C,) or official) replacements))
E746175001	L67	)
E746352001	L56	BS 1453/NG6, BS 2901/NG6, or official replacements

Pipe Material and Filler Rod
Table 801

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure

supply.

(b) Use clean kerosine and pressurize the pipe to 15 psig (1.035 bar) for a period of 15 min.

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine, and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) Mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

3. Multiple Cracks (Ref. Fig. 802)

R CAUTION: THIS REPAIR MUST NOT BE CARRIED OUT WITH THE PIPE
R INSTALLED IN THE AIRCRAFT.

A. Equipment and Materials

(1) Refer to paragraph 2.A.

B. Prepare to Repair Multiple Cracks

(1) Remove the pipe from the aircraft.

C. Repair Multiple Cracks

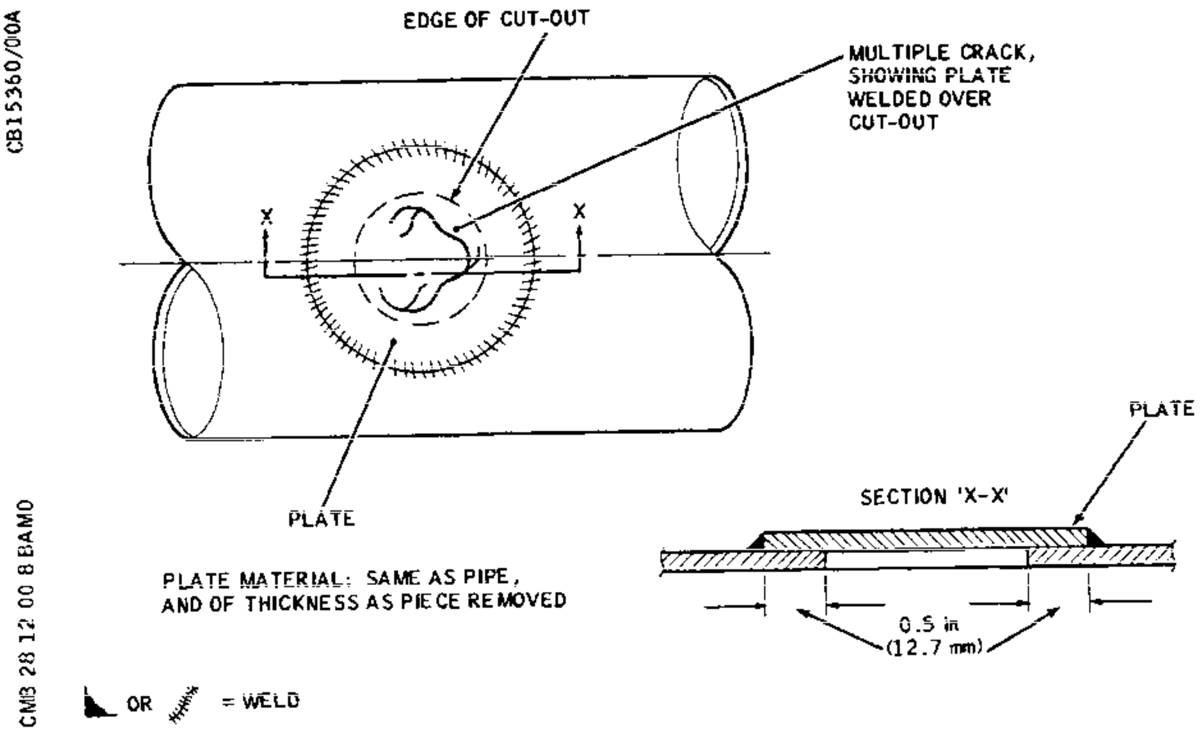
(1) Remove the protective treatment from the affected area.

(2) Determine the ends of the cracks, using radiographic equipment or penetrant.

(3) Cut a hole of a regular rounded shape and of a size sufficient to remove the cracks.

(4) Make a reinforcing plate of the material and with the overlap as shown on the illustration (Ref. Fig. 802). Shape the plate to suit the contour of the pipe.

(5) Weld the plate to the pipe, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.



Multiple Cracks - Repair
Figure 802

D. Conclusion

(1) Check the serviceability of the weld by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe to 15 psig (1.035 bar) for a period of 15 min.

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine, and

remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) Mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

4. Pipe and Support Ring Crack (Ref. Fig. 803)

R CAUTION: THIS REPAIR MUST NOT BE CARRIED OUT WITH THE PIPE
R INSTALLED IN THE AIRCRAFT.

A. Equipment and Materials

(1) Refer to paragraph 2.A.

B. Prepare to Repair Pipe and Support Ring Crack

(1) Remove the pipe from the aircraft.

C. Repair Pipe and Support Ring Crack

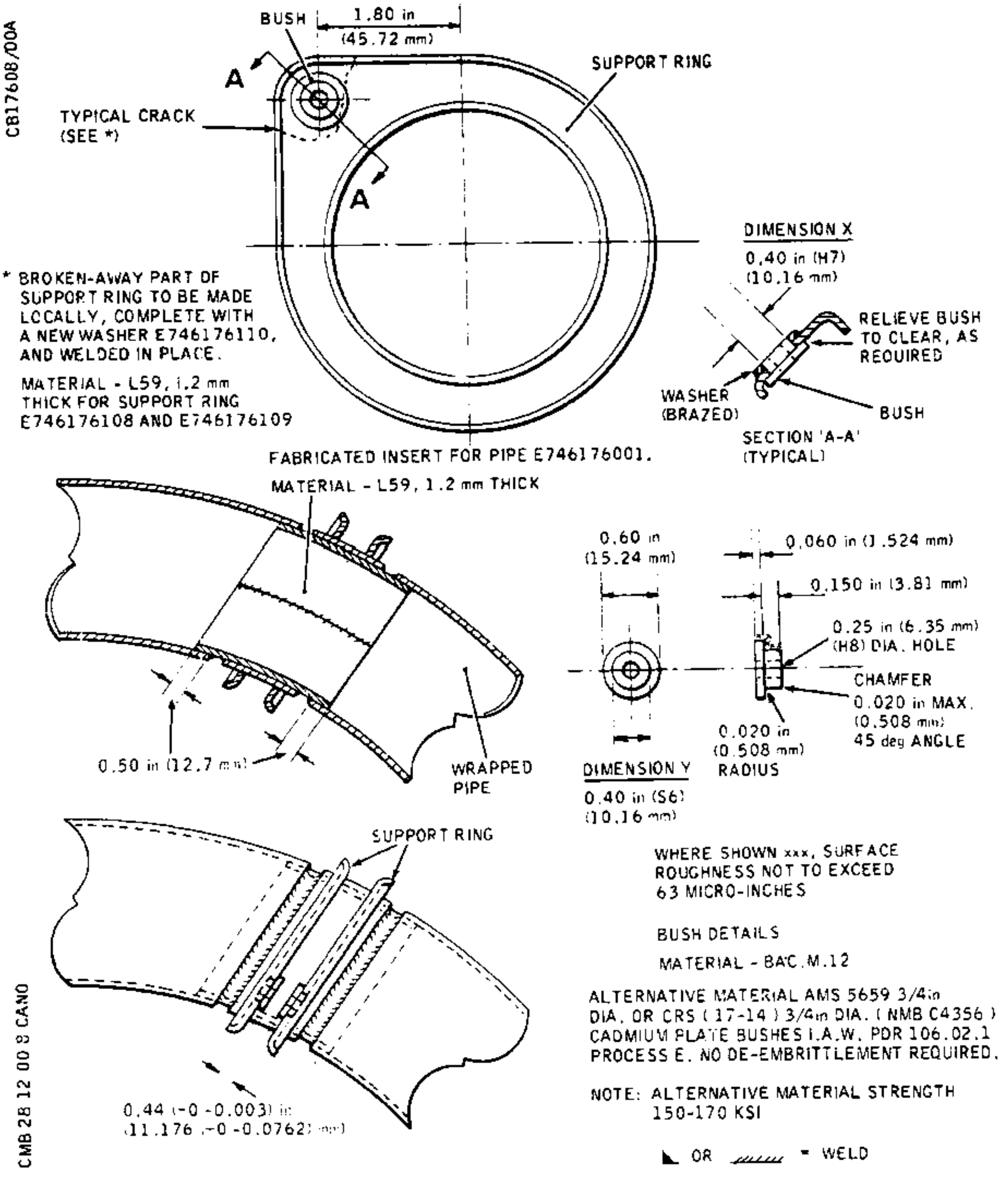
(1) Remove the protective treatment from the affected areas.

(2) Make a jig or fixture to suit the vent pipe and support rings.

NOTE: This is required to ensure that, after completion of the repair, the pipe and support rings are positioned exactly to their original geometry, and that the total length of the pipe has not altered.

(3) Remove the support rings, as a pair, by cutting the pipe at each side. Remove, from each cut end of the pipe, sufficient length to allow for two separate welds at the side of each support ring (Ref. Fig. 803).

(4) Using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801, weld all cracks in the pipes sector, from the inside, and weld the crack in the support ring. If the support ring is cracked around the bolt hole, refer to the note preceding paragraph 5.C.(2).



Pipe and Support Ring Crack - Repair
Figure 803

R B

(5) Dress the weld inside the pipe.

(6) Make an insert of length equivalent to the amount of pipe removed plus 1.0 in (25.4 mm), as illustrated (Ref. Fig. 803)

(7) Deburr and clean-up the ends of the pipe and the insert.

(8) Place the support rings on the insert and position the insert in the pipe ends.

(9) Place the complete assembly in the jig or fixture.

(10) Correctly position the support rings and insert; tack-weld the insert to the pipe, and the support rings to the insert.

(11) Ensure that the pipe and support rings are geometrically correct and then complete the welding process.

D. Conclusion

(1) Check the serviceability of the welds by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe to 15 psig (1.035 bar) for a period of 15 min.

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine, and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) Mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external

surfaces of the repaired area in accordance with 20-24-19.

5. Support Ring Crack (Ref. Fig. 803)

CAUTION: THIS REPAIR MUST NOT BE CARRIED OUT WITH THE PIPE INSTALLED IN THE AIRCRAFT.

NOTE: These procedures apply to a cracked support ring only. If the pipe also is cracked, the repair procedure detailed in paragraph 4. is applicable.

A. Equipment and Materials

DESCRIPTION	PART NO.
Radiographic flaw-detection equipment	-
Penetrant, for crack detection	-
Argon Arc welding equipment	-
Magnetic flaw-detection equipment	-
Filler rods (Ref. Table 801)	-
Cadmium-plating equipment	-
R R Cleaning solvent (Ref. 20-30-00, No.473)	-
Bristle brush (soft)	-
R Cooling agent (-40 deg C) (Ref. 20-30-00, No.167)	-
Kimwipe tissues, or clean lint-free cloth	-

B. Prepare to Repair Support Ring Crack

(1) Remove the pipe from the aircraft.

C. Repair Support Ring

(1) Remove the protective treatment from the affected

area.

NOTE: If the corner of a support ring is broken away ignore operation (2) and carry out operation (3).

(2) Weld the crack in the support ring, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.

(3) Locally, manufacture a new corner, using material as quoted on the illustration (Ref. Fig. 803). Weld the new corner to the support ring.

(4) Check the serviceability of the weld(s) by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(5) Make two bushes (Ref. Fig. 803), as follows:-

(a) Obtain sufficient material, BAC.M.12; this is fully heat-treated (solution-treated and precipitated).

(b) Machine, or grind, to the sizes quoted on the illustration.

(c) If the bushes were machined, no stress-relieving procedure is necessary. If the bushes were ground, stress-relieve at a temperature of between 190 to 210 deg C for 1 h.

(d) Carry out the magnetic flaw-detection process.

(e) Carry out the cadmium-plating process.

(6) Through the support ring and washer, and on the original centres, drill and line-ream the holes, dimension X, (Ref. Fig. 803), to accommodate the bush (dimension Y).

(7) Mask all areas of dry lubrication, areas of bare metal used for electrical bonding, and previously reamed holes. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

(8) Clean the bushes, as follows:-

CAUTION: DO NOT HANDLE THE BUSHES AFTER CLEANING; INSTEAD, USE A SUITABLE CLEAN TOOL.

(a) Apply cleaning solvent, BAC.M.302, using a soft bristle brush or soft cotton cloth.

(b) Remove any loosened contaminant with further applications of the solvent and cotton cloth.

(c) Ensure that the bushes are clean, and then dry them, using warm air or dry, cotton cloth. Finally, wipe the bushes with clean Kimwipe tissues.

(9) Shrink and insert the bushes as follows:-

WARNING: DO NOT HANDLE THE BUSHES AFTER COOLING, OTHERWISE SKIN BURNS WILL RESULT; USE A SUITABLE CLEAN TOOL.

(a) Make a suitable fixture for insertion of the bushes.

(b) Cool the bushes to -40 deg C, or below, using any suitable means (e.g., Drikold, refrigerator, etc.), allow the bushes to 'soak' at this temperature for at least 15 min.

(c) Remove the bushes from the cooling agent and immediately fit them into the support ring and washer.

(d) Allow the assembly to attain room temperature, checking that the bushes remain correctly seated.

6. Fuel Pressurizing Pipe Crack - Temporary Repair (Ref. Fig.804 and 805)

NOTE: After SB 28-032 this scheme is not applicable.

A. Equipment and Materials

DESCRIPTION	PART NO.
Radiographic flaw detection equipment	-
Penetrant, for crack detection	-

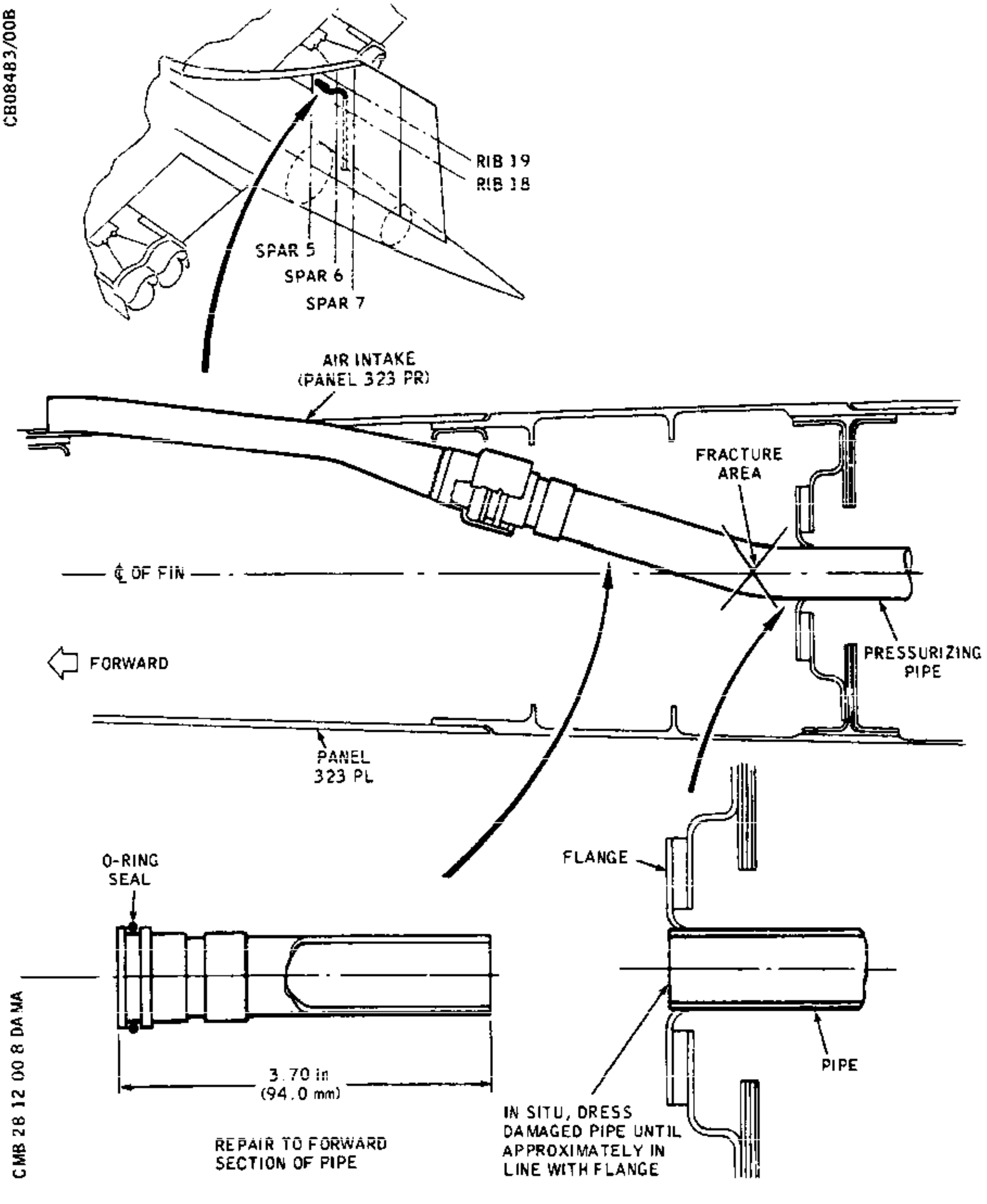
DESCRIPTION	PART NO.
Argon Arc welding equipment	-
Filler rods	BS 1453/NG6 BS 2901/NG6, or official replacements
Suitable blanks for pipe ends, with one blank adapted for connection of a kerosine pressure supply	-
Clean kerosine	-
Pump, capable of pressurizing kerosine to 15 psig (1.035 bar)	-
Kimwipe tissues, or clean lint-free cloth	-
Air supply rig, capable of producing a pressure of 10 psig (0.690 bar)	-
Fuel manometer	-
Flow test adapter blank	E925049000
Air intake plug	E935055000
Sealant, PR 1422 or PR 1422 BT (Ref. 20-30-00, No.377 or No.379)	-
R Cleaning solvent R (Ref. 20-30-00, No.473)	-

B. Prepare to Repair Fuel Pressurizing Pipe

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

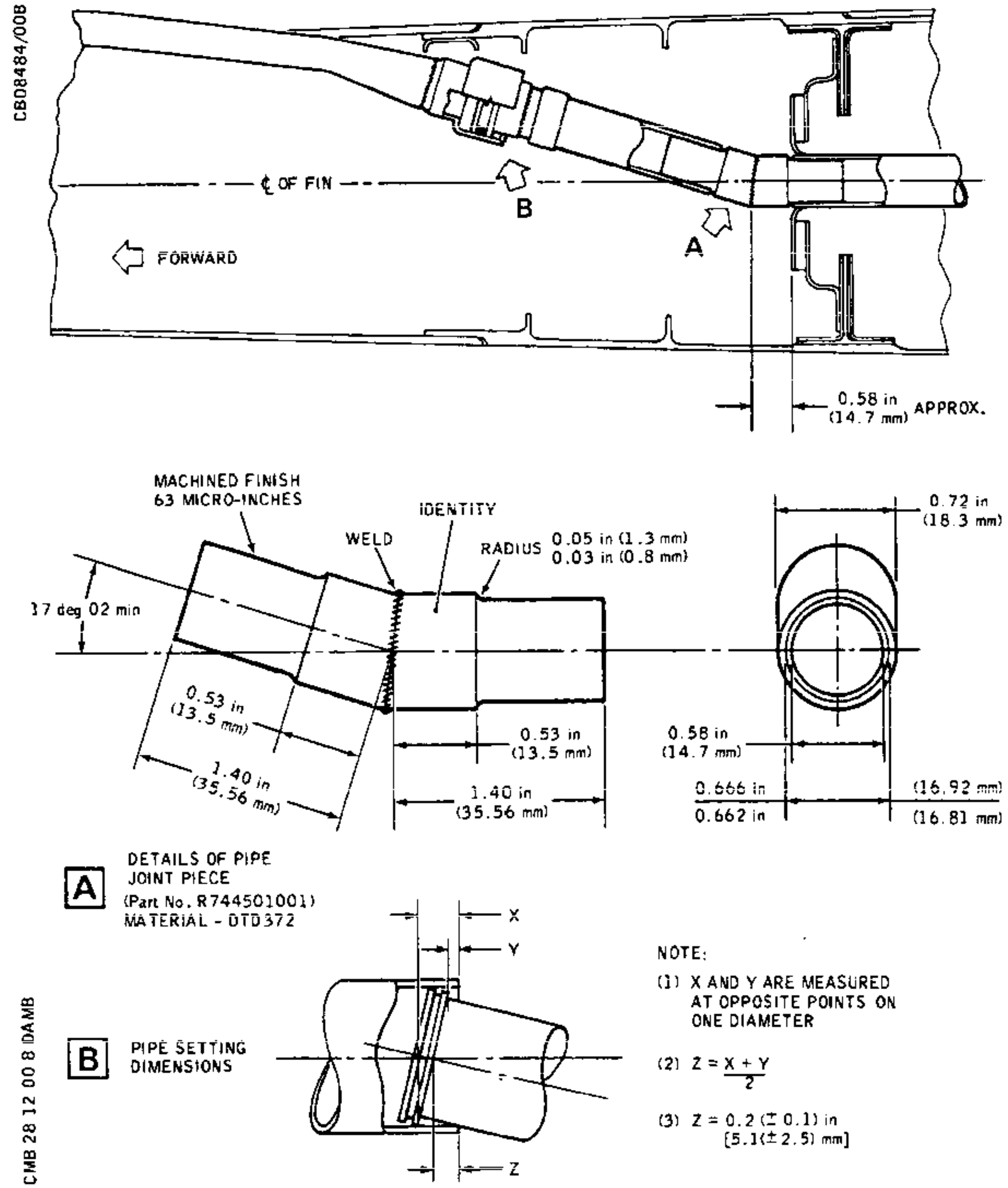
OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

(1) Remove panel 323 PL.



- Fin Pressurizing Pipe - Temporary Repair
(Sheet 1 of 2)
Figure 804

R



- Fin Pressurizing Pipe - Temporary Repair
(Sheet 2 of 2)
Figure 804

(2) Disconnect the electrical bonding at the forward section of pipe.

(3) To contain any debris, suitably protect the area below the damaged pipe.

(4) Support the forward section of pipe and remove air intake panel 323 PR.

(5) Remove the forward section of pipe.

C. Repair Piping (Ref. Fig. 804)

(1) Cut the forward section of pipe to length and deburr it.

(2) Protect the cut end with one coat of barium chromate epoxy primer (Ref. 20-24-19).

(3) To prevent debris entering the fixed pipe in the fin, fit a suitable one-piece bung into the pipe.

(4) Dress and deburr the damaged pipe.

(5) Remove the bung and any debris from the pipe.

(6) Protect the pipe-end with barium chromate epoxy primer (Ref. 20-24-19).

D. Fabricate Pipe Joint-piece

(1) Construct a pipe joint-piece as illustrated (Ref. Fig. 804) (Detail A).

(2) Check the welding, using radiographic and penetrant processes.

(3) Suitably blank off and pressurize the joint-piece, using clean kerosine at 15 psig (1.035 bar) for 10 min. No leakage is permitted.

(4) Using the Vibro-Etch process, mark on the joint-piece the identity (Part Number and material batch number).

(5) Anodize the joint-piece, using the chromic acid process.

E. Install Joint-piece (Ref. Fig. 804) (Sht.2)

(1) Lubricate (Ref. 20-23-11) and fit a new O-ring seal to the forward pipe section.

R (2) Mix sealant to the manufacturer's instructions.

R (3) Using the cleaning solvent, clean and dry the spigot sections of the joint-piece and the internal bore of the pipe sections to a depth of not less than 1 in (25 mm).

R CAUTION: TO PREVENT SEALANT 'BUILD-UP' IN THE PIPE BORES, DO NOT APPLY SEALANT TO THE EXTREME ENDS OF THE JOINT-PIECE SPIGOT SECTIONS. LEAVE APPROXIMATELY 0.1 in (2.5 mm) NOT COVERED.

R (4) Thoroughly coat the spigot sections with sealant.

R (5) Fit the joint-piece to the pressurizing fixed pipe and position the weld line as indicated.

R (6) Fit the forward section of the pipe to the joint-piece; then fit the air intake panel to the forward section of pipe.

R (7) Secure the air-intake panel with the screws.

R (8) Check the pipe setting dimensions (Ref. Detail B); adjust the forward pipe section if necessary.

R (9) Smooth the sealant to form a fillet between the pipe-ends and the joint-piece.

R (10) Allow the sealant to become tack-free.

R (11) Apply barium chromate epoxy primer (Ref. 20-24-19) to the pipe joint-piece.

R (12) Reconnect the bonding lead (Ref. 20-27-11).

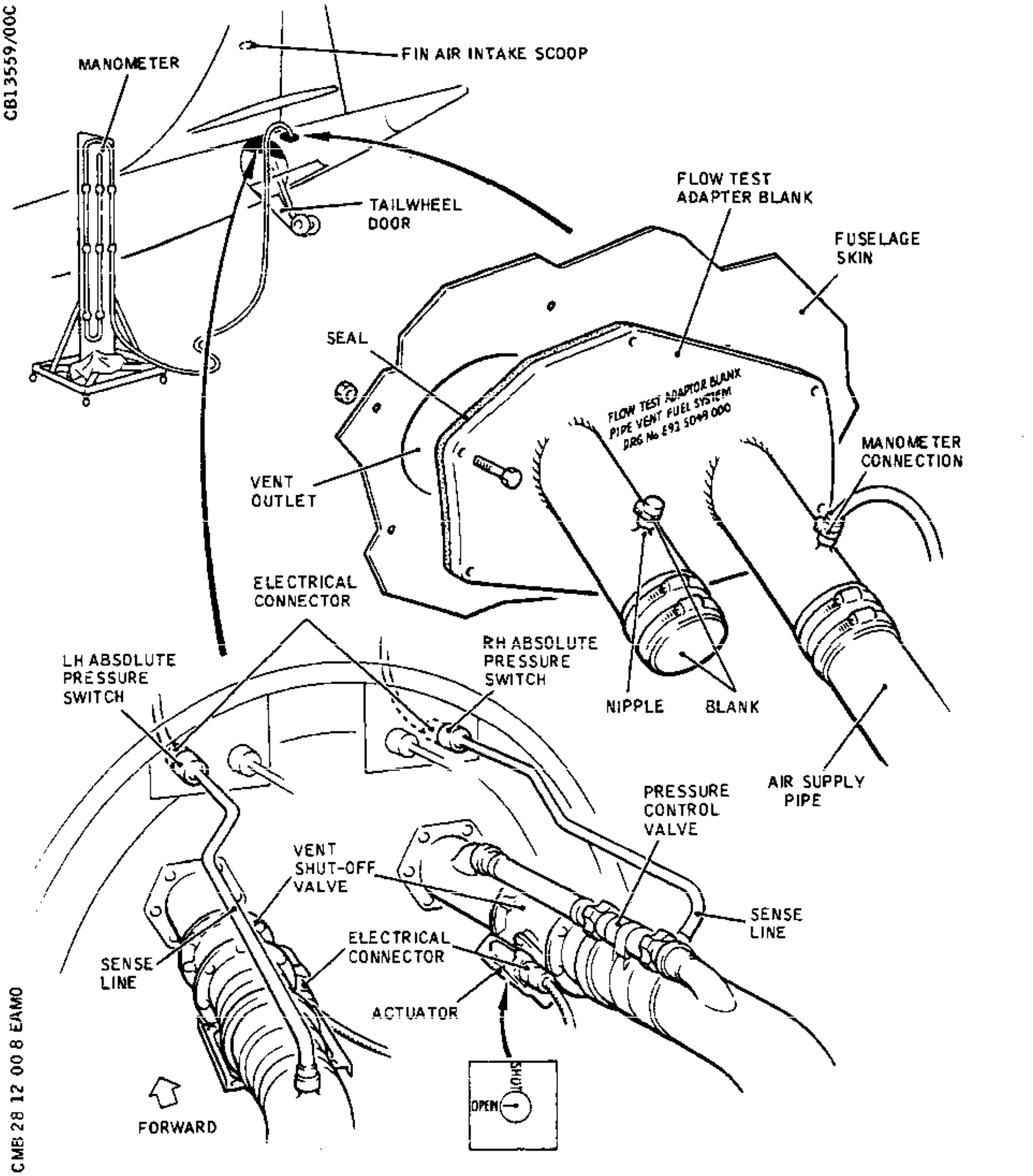
R F. Test (Ref. Fig. 805)

R (1) Ensure that all fuel tank panels are fitted.

R (2) Ensure that all fuel management panel switches and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place placards on both panels warning that the position of the switches must not be changed.

R (3) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

R (4) Ensure that the vent shut-off valves are open.



R - Test Equipment - Installation
Figure 805

(5) Remove the six countersunk bolts and nuts from the skin surrounding the vent outlets.

(6) Secure a flow test adapter blank to the vent outlet with the bolts and nuts supplied.

(7) Fit blanks to one adapter outlet pipe and nipple.

(8) Connect an air supply rig and a manometer to the other adapter outlet pipe.

(9) Set the manometer to release the pressure at 2 psig (0.138 bar).

(10) Fit an air intake plug to the air intake scoop.

(11) Pressurize the vent system to 2 psig (0.138 bar).

(12) Remove the air intake plug from the air intake scoop. Check for a free flow of air, as the vent system exhausts through the scoop.

(13) Refit the air intake plug to the air intake scoop.

(14) Pressurize the vent system to 2 psig (0.138 bar) for 10 min.

(15) During the 10 min period use soap solution (Ref. 20-23-12) to check the repair area for freedom from leaks.

G. Conclusion

(1) Release the air pressure and remove the test rig, manometer, and plug from the scoop.

(2) Remove the flow test adapter and refit the six countersunk bolts and nuts previously removed.

(3) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(4) Remove any debris and debris-containment protection.

(5) Ensure that the repair area in the fin is clean and free from debris and loose objects.

(6) Refit access panel 323 PL.

(7) Remove the warning placards.

END OF THIS SECTION

NEXT

TANK PRESSURE RELIEF VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The sixteen pressure relief valves are mounted immediately below the wing upper surface in tanks 1, 4, 5, 6, 7, 9 and 10. The valves are fitted to flanges on branches of the vent pipe by means of latches which are secured by captive bolts.

2. Tank Pressure Relief Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure, by reference to the fuel quantity indicator, that the fuel level in the appropriate tank is below 90 per cent full; if necessary, transfer fuel (Ref. 28-00-00, Servicing), or partially defuel (Ref. 25-00-00, Servicing) the tank.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel door is shut. Place placards at both panels warning that the settings of the switches must not be altered.

(4) Trip the following circuit breakers and fit safety

clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL CONT AND FAIL IND	15-215	Q513	E20
REFUEL SHUT-OFF AND VENT VALVES IND	15-215	Q511	E19

(5) Remove the appropriate access panel in the wing upper surface.

NOTE: In tanks 1 and 4 the access panel is also the cover of the vent box below. This also applies to one of the three valves in tanks 6 and 7.

C. Remove

(1) Disconnect the electrical harness cables from the terminal block on the valve, leaving the leads to the internal reed switch in position.

(2) Release the captive bolts from the flange on the vent pipe and disengage the latch from the flange.

CAUTION: TO AVOID POSSIBLE DAMAGE, THE VALVE MUST NOT BE HANDLED BY ITS FLOAT.

(3) Remove the valve and remove and discard the O-ring seal from the valve at the valve-to-vent pipe connection.

D. Install

(1) Observe the fuel and electrical safety precautions.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the valve at the valve-to-vent pipe connection.

CAUTION: TO AVOID POSSIBLE DAMAGE, THE VALVE MUST NOT BE HANDLED BY ITS FLOAT.

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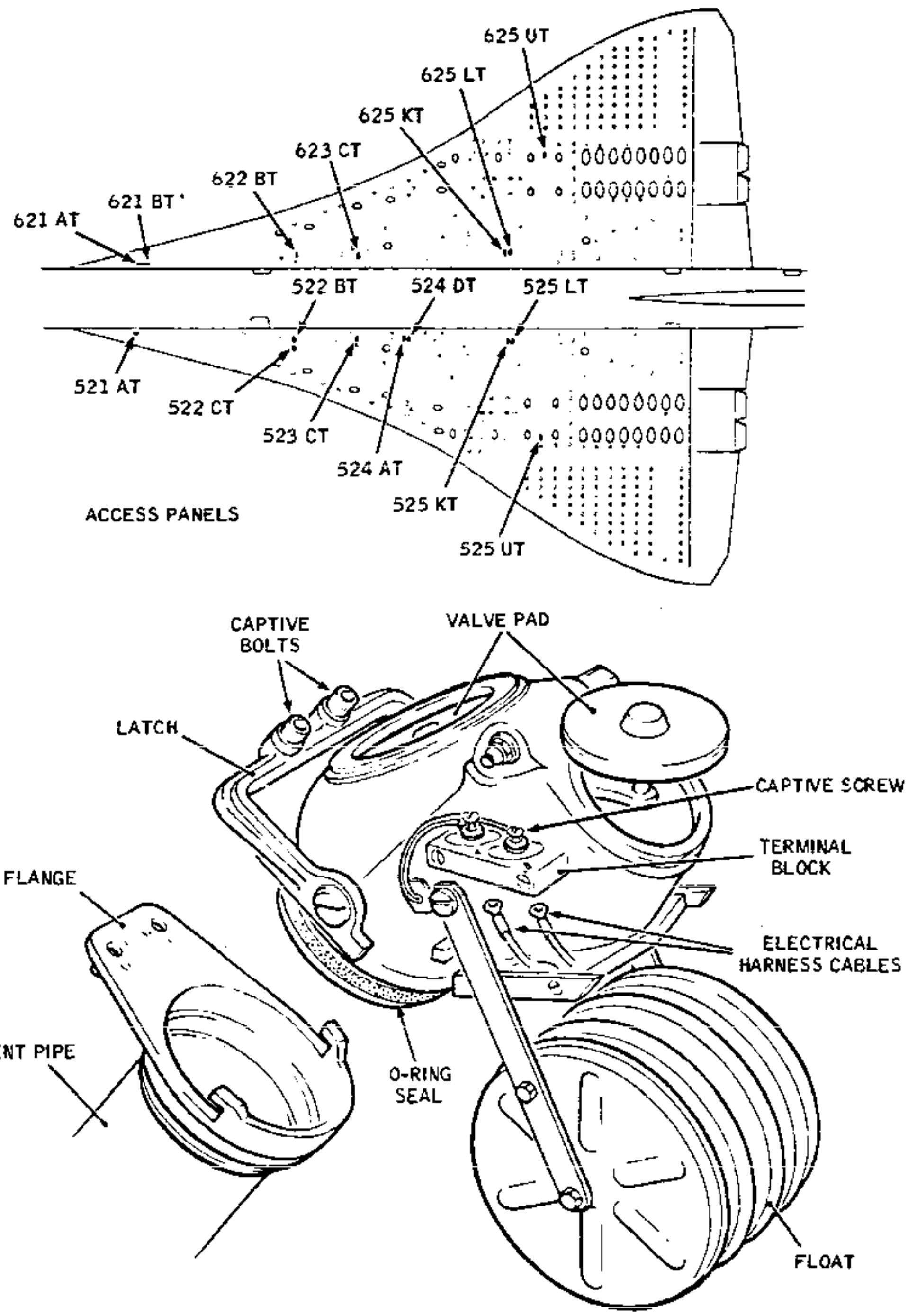

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R - Tank Pressure Relief Valve - Installation
Figure 401

(3) Position the valve and engage the latch in the notch on the pipe flange. Secure the captive bolts to the anchor nuts through the two holes in the flange. Torque-tighten each bolt to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(4) Connect the electrical harness cables to the terminal block at the side of the valve body, ensuring that
R the connections are made in accordance with the
R cable identification and the applicable diagram in
R the Wiring Diagram Manual.

R (5) Torque-tighten the captive screws in the terminal
R block to between 8 and 9 lbf in (0.090 and 0.102
R mdaN).

R E. Conclusion

R (1) Refit the access panel in accordance with 57-00-00,
R Removal/Installation, ensuring that the bonding is intact.

R (2) Remove the safety clips and reset the circuit
R breakers previously tripped.

R (3) Remove the warning placards.

R (4) Carry out the Mechanical Test and both Functional
R Tests (Procedures 1 and 2) of the valve (Ref.
R Adjustment/Test).

TANK PRESSURE RELIEF VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises a Mechanical Test and two differing Functional Tests of a tank pressure relief valve (TPRV).

The Mechanical Test is carried out whenever a tank is entered. The Functional Tests check the valve position indications on the refuel control panel either -

(a) by the manual raising and lowering of the valve float if the valve access panel has been removed (Procedure 1), or

(b) by the filling of the appropriate tank with fuel (Procedure 2).

Operational and System Tests are not applicable.

2. Mechanical Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure, by reference to the fuel quantity indicator, that the fuel level in the appropriate tank is below 90 per cent full; if necessary, transfer fuel (Ref. 28-00-00, Servicing) or partially defuel (Ref. 28-25-00, Servicing) the tank.

(3) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel door is shut. Place placards at both panels warning that the settings of the switches must not be altered.

(4) Remove the appropriate access panel (Ref. Removal/Installation) to gain access to the TPRV.

B. Test

CAUTION: TO AVOID POSSIBLE DAMAGE, DO NOT HANDLE THE

R VALVE BY ITS FLOAT.

R (1) Manually check the float movement of the TPRV for full and free operation of the linkage and check that the valves seat correctly.

R C. Conclusion

R (1) Refit the tank access panel as detailed in 57-00-00, Removal/Installation.

R (2) Remove the warning placards.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 3. <u>Functional Test (Procedure 1)</u>

R A. Prepare

R (1) Make available electrical ground power as detailed in 24-41-00.

R (2) Ensure, by reference to the fuel quantity indicator, that the fuel level in the appropriate tank is below 90 per cent full. If necessary, transfer fuel (Ref. 28-00-00, Servicing) or partially defuel (Ref. 28-25-00, Servicing) the tank.

R (3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard on the panel warning that the settings of the switches must not be altered.

R (4) Remove the appropriate access panel (Ref. Removal/ Installation) to gain access to the TPRV.

R B. Test

R (1) Ensure that the valve float is fully lowered.

R (2) Open the refuel control panel door and set the refuel master switch to "SET UP".

R (3) Set the TPRV selector switch on the refuel control panel to the appropriate valve; check that the PRV caption is illuminated.

R <u>CAUTION:</u> TO AVOID POSSIBLE DAMAGE, DO NOT HANDLE THE VALVE BY ITS FLOAT.

R (4) Manually raise the TPRV float to the fully raised position and check that the PRV caption is extinguished.

R (5) Lower the float to the fully lowered position and check that the PRV caption is illuminated.

R (6) Press the TPRV EARTH TEST switch and check that the PRV caption is extinguished; release the test switch and check that the PRV caption is illuminated.

R C. Conclusion

R (1) Refit the tank access panel as detailed in 57-00-00, Removal/Installation.

R (2) Reset the TPRV selector switch counter-clockwise to "NORMAL".

R (3) Set the refuel master switch to "OFF" and close the refuel control panel door.

R (4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 4. Functional Test (Procedure 2)

R A. Prepare

R (1) Make available electrical ground power as detailed in 24-41-00.

R (2) Ensure, by reference to the fuel quantity indicator, that the fuel level in the appropriate tank is below 90 per cent full. If necessary, transfer fuel (Ref. 28-00-00, Servicing), or defuel (Ref. 28-25-00, Servicing) the tank.

R (3) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

R B. Test

R (1) Open the refuel control panel door and set the refuel master switch to "SET UP".

R (2) Set the TPRV selector switch to the valve under test; check that the PRV caption is illuminated, indicating

R that the valve is open.

R (3) Press the TPRV EARTH TEST switch; check that the PRV caption is extinguished. Release the test switch; check that the PRV caption is illuminated.

R (4) Refuel the appropriate tank to high level (Ref. 12-11-28). Check that the PRV caption is extinguished.

R (5) Reset the TPRV selector switch counter-clockwise to "NORMAL". Check that the PRV caption remains extinguished.

R C. Conclusion

R (1) Remove the warning placard.

R (2) Set the refuel master switch to "OFF" and close the refuel control panel door.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

AIR-NO-FUEL VALVES AND VENT DRAIN VALVES - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General (Ref. Fig. 401)

There are 30 air-no-fuel valves and 25 vent drain valves fitted throughout the vent system. Most of the valves are fitted to attachment elbow pipes which are, in turn, bolted to flanges on vent stub pipes and supported by mounting brackets or boxes. The attachment elbows may have either a single air-no-fuel valve or vent drain valve mounted on them, or both.

In most cases it is necessary to first remove the attachment elbow from the tank, complete with valve or valves, due to restricted access in the tank and because the drain valves and some air-no-fuel valves are secured to their attachment elbows with non-captive bolts.

Some of the valves are fitted in vent boxes which may also contain a tank pressure relief valve (TPRV). Removal of the TPRV is necessary before the valve can be removed (Ref. Table 401).

Access to the valves is gained by removing the appropriate panel (Ref. Fig. 401). Table 401 comprises details of the equipment and its location in relation to the access panel (Ref. Fig.401 and 402). In some cases, the equipment is directly under the panel.

Access panels below tank 2 and 3 (Table 401, items 34 and 36) provide easier access to the equipment in the top forward part of the tank; the tank must first be drained (Ref. 28-25-00, Servicing) and prepared for entry (Ref. 28-10-00, Servicing).

TANK	ITEM	ACCESS PANEL	DETAIL (Ref. Fig. 402)	LOCATION P	LOCATION Q (in)	TPRV REMOVAL REQUIRED
9 LH	1	521 AB	C	12	6	-
9 LH	2	521 AT	F	3	3	Yes
9 LH	3	521 CT	A	2	8	-
9 LH	4	521 DT	B	6	12	-
9 RH	5	621 AB	C	12	6	-

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R

	TANK	ITEM	ACCESS PANEL	DETAIL (Ref. Fig. 402)	LOCATION P	Q (in)	TPRV REMOVAL REQUIRED
R	9 RH	6	621 AT	F	9	3	Yes
R	9 RH	7	621 CT	A	10	8	-
R	9 RH	8	621 DT	B	6	12	-
R	10 LH	9	522 BT	F	2	8	Yes
R	10 LH	10	522 FT	A	3	15	-
R	10 RH	11	622 BT	F	10	8	Yes
R	10 RH	12	622 FT	A	9	15	-
R	1	13	523 AT	F	12	2	-
R	1	14	523 CT	C	Under panel		Yes
R	1	15	523 GT	D	6	6	-
R	1	16	193 AB	G	Above panel		-
R	4	17	623 AT	F	12	2	-
R	4	18	623 CT	C	Under panel		Yes
R	4	19	623 GT	D	6	6	-
R	4	20	194 AB	G	Above panel		-
R	5	21	524 AT	F	12	4	Yes
R	5	22	524 QT	A	Under panel		-
R	5	23	524 JT	A	3	12	-
R	8	24	624 JT	F	9	12	-
R	6	25	525 AT	C	3	3	-
R	6	26	525 KT	F	2	3	Yes
R	6	27	525 UT	E	Under panel		Yes
R	6	28	525 BU	A	9	6	-

TANK	ITEM	ACCESS PANEL	DETAIL (Ref. Fig. 402)	LOCATION P	LOCATION Q (in)	TPRV REMOVAL REQUIRED
7	29	625 AT	C	9	3	-
7	30	625 KT	F	10	3	Yes
7	31	625 UT	E	Under panel		Yes
7	32	625 BU	A	3	6	-
7	33	625 ZT	A	7	12	-
2	34	526 AB	F	Top of tank		-
2	35	526 ET	D	2	12	-
3	36	626 AB	F	Top of tank		-
3	37	626 FT	A	Under panel		-
3	38	626 ET	D	10	12	-
5A	39	527 KU	A	6	4	-
7A	40	627 KU	A	6	4	-

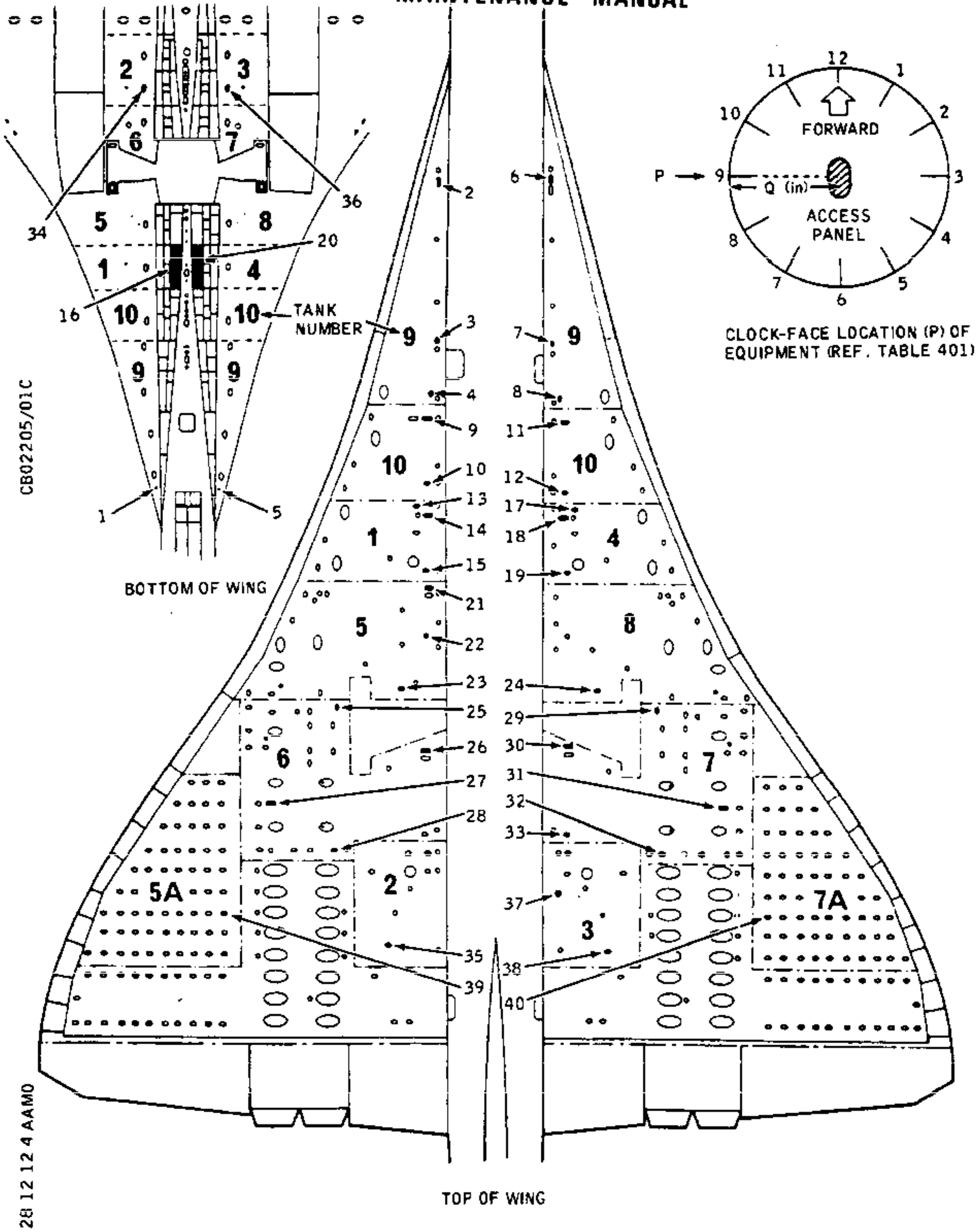
NOTE: Under LOCATION, column P gives the 'clock-face' direction of the component from the access panel, column Q its distance in inches from the access panel.

Valve Access and Location Data (Ref. Fig.401)
Table 401

2. Air-no-fuel Valve or Vent Drain Valve (in Pipes) (Ref. Fig. 402)

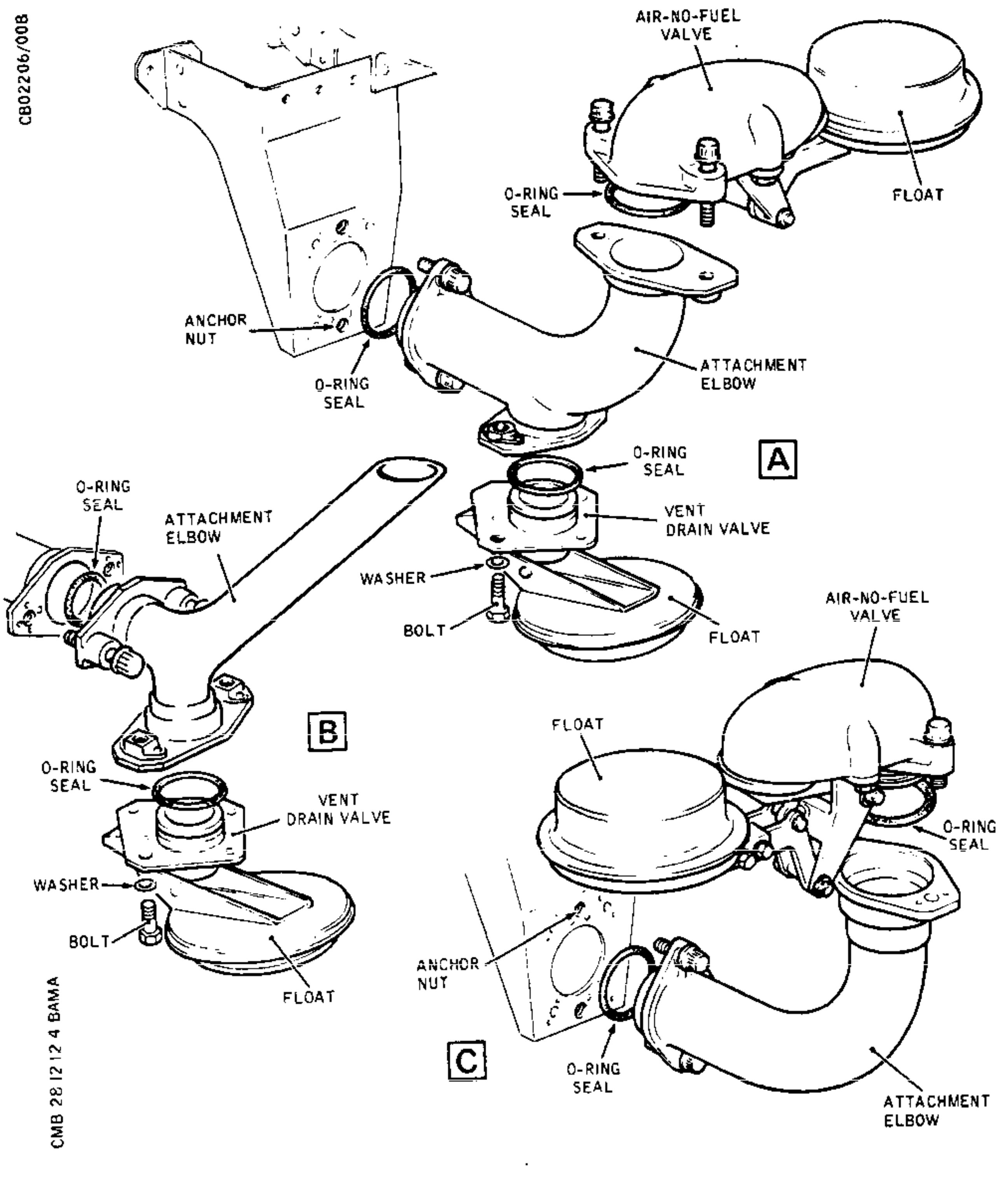
A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-



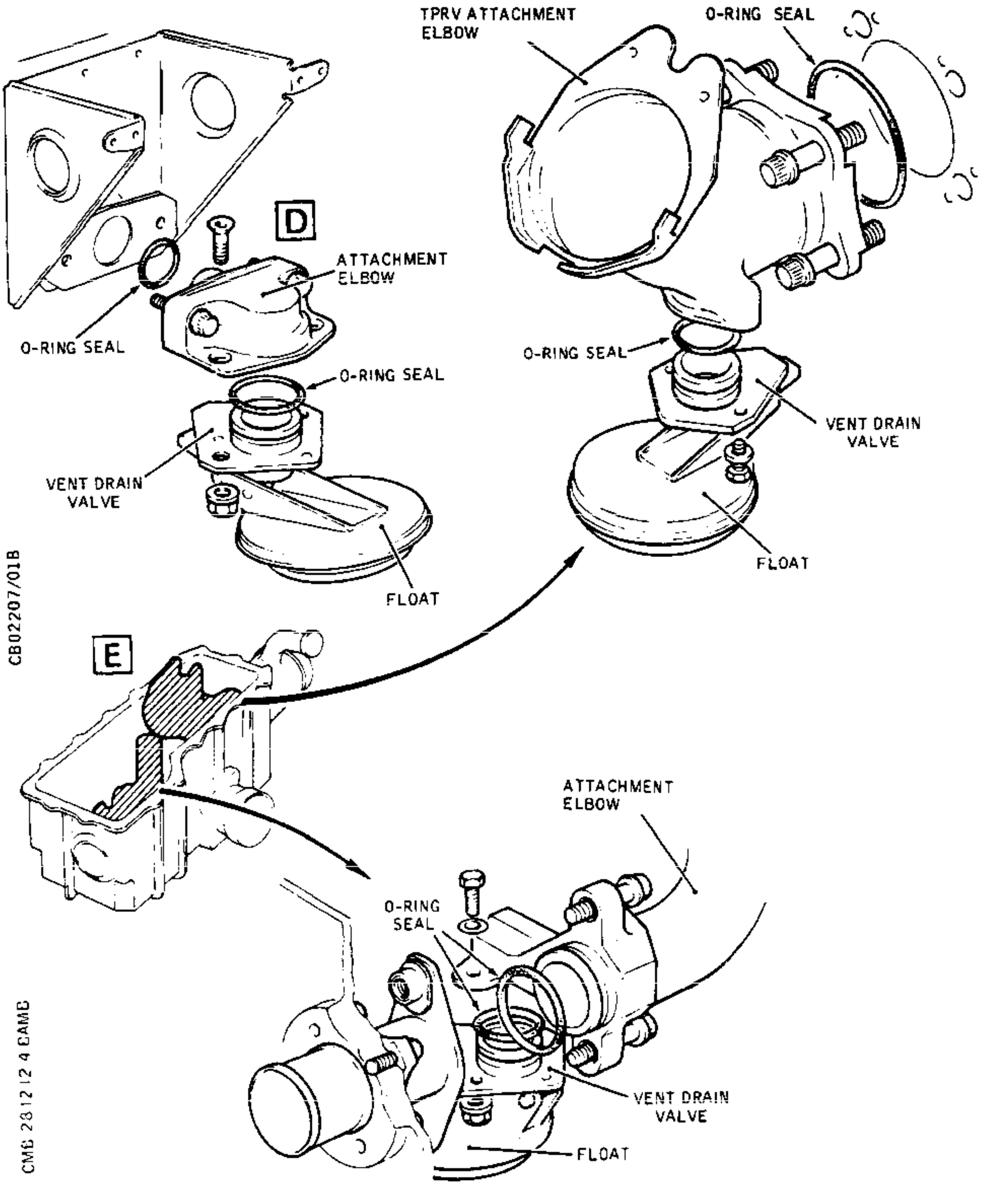
FOR KEY TO EQUIPMENT, REFER TO TABLE 401.

R - Air-no-fuel and Vent Drain Valves - Access Panels
Figure 401



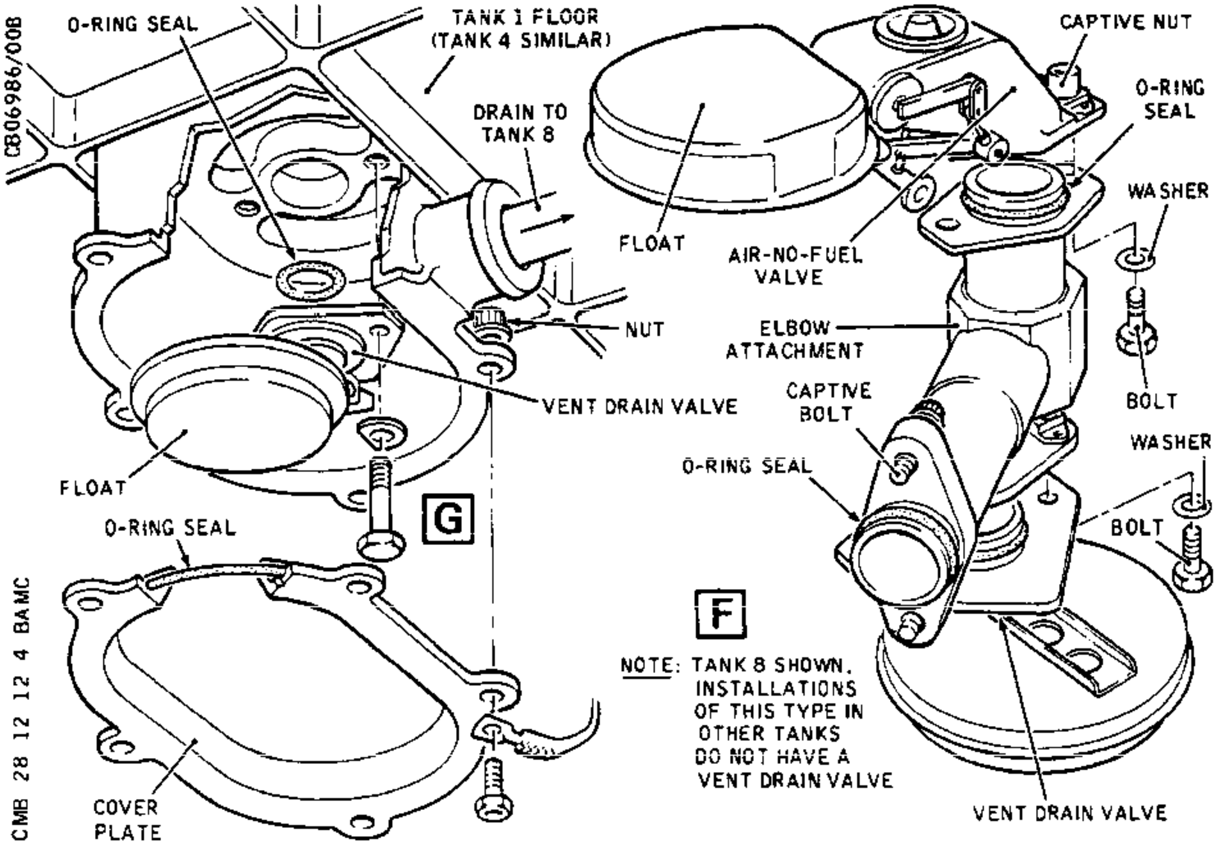
\- Air-no-fuel Valves and Vent Drain Valves -
Installation (Sheet 1 of 3)
Figure 402

R



\- Air-no-fuel Valves and Vent Drain Valves -
Installation (Sheet 2 of 3)
Figure 402

R



- Air-no-fuel Valves and Vent Drain Valves - Installation (Sheet 3 of 3)
R Figure 402

R B. Prepare to Remove Valve (in Pipes)

R (1) Ensure that the fuel level in the appropriate tank
R is below high level. Transfer fuel or defuel if
R necessary (Ref. 28-25-00, Servicing).

R (2) Remove the appropriate access panel (Ref. Table 401).

R (3) Remove the tank pressure relief valve if necessary
R (Ref. Table 401 and 28-12-11, Removal/Installation).

R (4) Release the captive bolts securing the attachment
R elbow to the vent pipe; remove the attachment elbow.

R (5) Remove and discard the O-ring seal from the attachment
R elbow.

R C. Remove Valve (in Pipes)

R (1) Release or remove the bolts securing the valve to

R the attachment elbow; remove the valve.

R (2) Remove and discard the O-ring seal from the valve.

R D. Prepare to Install Valve (in Pipes)

R (1) Check that the mating surfaces of the valve and
R attachment elbow are clean and undamaged, then fit
R a new O-ring seal, lubricated in accordance with
R 20-23-11, to the valve.

R E. Install Valve (in Pipes)

R (1) Secure the valve to the attachment elbow with the
R bolts. Torque-tighten each bolt to between 40 and
R 49 lbf in (0.452 and 0.554 mdaN).

R (2) Check the valve float for full and free movement.

R F. Conclusion

R (1) Check that the mating surfaces of the attachment
R elbow and vent pipe are clean and undamaged, then
R fit a new O-ring seal, lubricated in accordance
R with 20-23-11, to the attachment elbow.

R (2) Secure the attachment elbow to the vent pipe with
R the captive bolts. Torque-tighten each bolt to
R between 40 and 49 lbf in (0.452 and 0.554 mdaN).

R (3) Refit the tank pressure relief valve if necessary
R (Ref. 28-12-11, Removal/Installation).

R (4) Check for full and free movement of all valve floats
R after installation.

R (5) Refit the access panel.

R 3. <u>Vent Drain Valve (in Vent Box)</u> (Ref. Fig. 402) (Detail E)

R A. Equipment and Materials
R

R	DESCRIPTION	PART NO.
R		
R R R	Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-

R B. Prepare to Remove Vent Drain Valve (in Vent Box)

(1) Remove the access panel which forms the vent box cover (Ref. Table 401).

(2) Remove the tank pressure relief valve (TPRV) (Ref. 28-12-11, Removal/Installation).

(3) Release the captive bolts securing the attachment elbow to the vent box; remove the attachment elbow.

C. Remove Vent Drain Valve (in Vent Box)

(1) Remove the bolts securing the valve to the attachment elbow; remove the valve and discard the O-ring seal.

D. Prepare to Install Vent Drain Valve (in Vent Box)

(1) Check that the mating surfaces of the valve and attachment elbow are clean and undamaged, then fit to the valve a new O-ring seal, lubricated in accordance with 20-23-11.

E. Install Vent Drain Valve (in Vent Box)

(1) Secure the valve to the attachment elbow with the bolts. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(2) Check the valve float for full and free movement.

F. Conclusion

(1) Secure the attachment elbow to the vent box with the captive bolts. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(2) Install the tank pressure relief valve (Ref. 28-12-11, Removal/Installation).

(3) Fit the access panel.

4. Vent Drain Valve (Below Tank 1 or 4) (Ref. Fig. 402) (Detail G)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-

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B. Prepare to Remove Vent Drain Valve (Below Tank 1 or 4)

(1) Ensure that the fuel level in the appropriate tank is below high level.

(2) Remove the appropriate access panel (Ref. Table 401).

(3) Remove the five bolts and the bonding lead from the box cover plate, noting the position of the special bonding bolt, which has a dimpled head.

(4) Remove and discard the O-ring seal from the cover plate.

C. Remove Vent Drain Valve (Below Tank 1 or 4)

(1) Remove the bolts securing the valve to the tank floor; remove the valve.

(2) Remove and discard the O-ring seal from the valve.

D. Prepare to Install Vent Drain Valve (Below Tank 1 or 4)

(1) Check that the mating surfaces of the valve and tank floor are clean and undamaged, then fit to the valve a new O-ring seal, lubricated in accordance with 20-23-11.

E. Install Vent Drain Valve (Below Tank 1 or 4)

(1) Secure the valve to the tank floor with the bolts. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(2) Check for full and free movement of the valve float.

F. Conclusion

(1) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the vent box cover plate.

(2) Secure the cover plate to the vent box with the five bolts, positioning the bonding lead beneath the head of the bonding bolt. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(3) Check that the electrical bonding is in accordance with 20-27-11.

(4) Refit the access panel.

AIR-NO-FUEL AND VENT DRAIN VALVES - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

CAUTION: IF ANY SLIMY AND/OR DISCOLOURED DEPOSITS ARE ENCOUNTERED DURING INSPECTION, REFER TO 12-32-00, 'MICROBIAL CONTAMINATION OF FUEL TANKS', FOR FURTHER INFORMATION.

1. General

There are 30 air-no-fuel valves and 25 vent drain valves fitted throughout the vent system. Most of the valves are fitted to attachment elbow pipes which are, in turn, bolted to flanges on vent stub pipes and supported by mounting brackets or boxes. The attachment elbows may have either a single air-no-fuel valve or vent drain valve mounted on them, or both.

Two types of air-no-fuel valves are used: one type has captive bolts for its attachment, with its valve head operating outside the valve body and closing against a bush in the lower surface of the valve body; the other has floating anchor nuts for its attachment, with its valve head operating within the valve body and closing against a bush in the top surface of the valve body. A seal is fitted to the valve head on each of these types.

The vent drain valves are all of the same type. The valve head closes against a seal attached to the valve body.

For equipment location and access, refer to Removal/ Installation, Figures 401 and 402 and Table 401.

2. Check

A. Equipment and Materials

DESCRIPTION	PART NO.
Explosion-proof torch	-
Inspection mirror	-

B. Prepare

(1) Ensure that the fuel level in the tanks is below

high level. Transfer fuel or defuel if necessary (Ref. 28-25-00, Servicing).

(2) Ensure that all switches on the fuel management panel are at their normal ground positions (Ref. 28-00-00, Servicing), and that the refuel control panel access door is closed.

(3) Attach placards to the fuel management and refuel control panel door, warning that tests are being carried out and that the position of the switches must not be altered.

(4) Remove all access panels associated with the valves (Ref. Removal/Installation, Figures 401 and 402 and Table 401).

C. Check

(1) Check that the float of each valve is hanging fully down at its mechanical limit, and that the valve head is well clear of its seat bush.

(2) Using the explosion-proof torch and mirror, check the seal, seat bush and mechanism for freedom from damage, corrosion and foreign objects.

(3) Gently lift the float to the limit of its travel. Check that the valve head seal seats firmly on its bush.

(4) Allow the float to fall under its own weight to the mechanical limit of its travel. Check that the mechanism operates freely and that there is no sound of fuel in the float.

D. Conclusion

(1) Refit the access panels previously removed, as detailed in 57-00-00, Removal/Installation.

(2) Remove the warning placards from the fuel management and refuel control panels.

THERMAL EXPANSION NON-RETURN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE ALL APPLICABLE PRECAUTIONS FOR ENTERING FUEL TANKS, AS DETAILED IN 28-10-00, SERVICING.

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1. General

The two thermal expansion non-return valves are bracket-mounted in collector tanks 1 and 3.

Removal of panel 523 DT in the wing top surface provides access to the valve in tank 1, which is near the top of the tank and 6 in (152 mm) inboard of the panel aperture.

Access to the valve in tank 3 is gained by entering the tank, after removal of panel 626 AB in the wing bottom surface.

2. Non-return Valve (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-

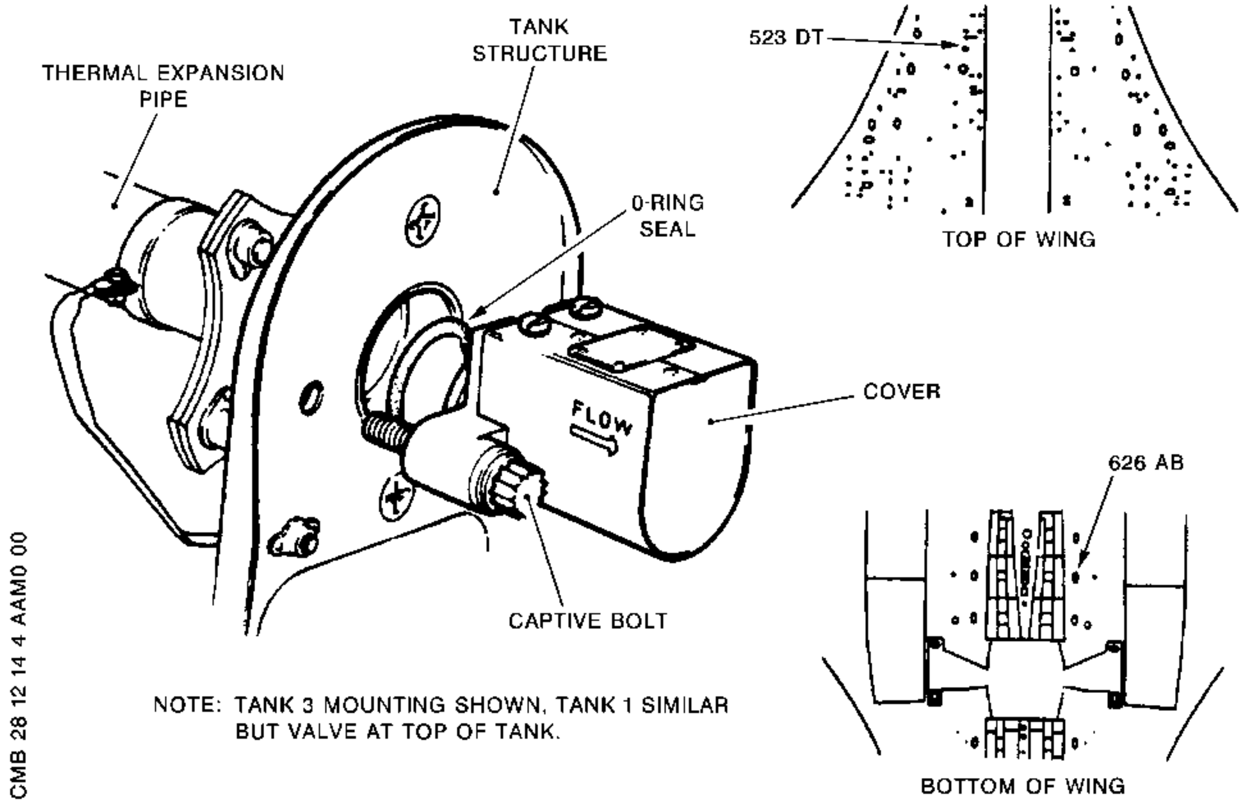
B. Prepare

(1) Defuel the appropriate collector tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(3) Remove the appropriate access panel.

(4) For removal of a tank 3 valve, prepare the tank for entry (Ref. 28-10-00, Servicing).



Thermal Expansion Non-return Valve - Installation
Figure 401

C. Remove

(1) Release the two captive bolts securing the valve to the tank structure and remove the valve. Fit a suitable blank to the pipe aperture.

(2) Remove and discard the O-ring seal from the inlet side of the valve. Fit suitable blanks to the valve apertures.

D. Install

(1) Remove the blanks from the valve pipe.

(2) Ensure that the mating surfaces of the valve and pipe are clean and undamaged. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the inlet side of the valve.

(3) Ensure that the spring-loaded flap valve operates freely and fully. Check that it seats correctly by spring pressure.

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(4) Secure the valve to the bracket with the captive bolts. Torque-tighten each bolt to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

E. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (2) Refit the access panel as detailed in 57-00-00, Removal/Installation.

R (3) Remove the warning placard.

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THERMAL EXPANSION NON-RETURN VALVE - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

Access for inspection of the two thermal expansion non-return valves, one in each of tanks 1 and 3, is gained by removing a panel, near each valve, in the top surface of the wing.

2. Check

A. Prepare

(1) Defuel the appropriate tank (Ref. 28-25-00, Servicing).

R (2) Ensure that all fuel management panel switches
R are at their normal ground settings (Ref. 28-00-00,
R Servicing) and the refuel control panel access
R door is closed. Place placards near the panels
R warning that the settings of the switches must
R not be altered.

R (3) Remove the appropriate access panel in the top surface of the wing (Ref. Table 601).

TANK NO.	ACCESS PANEL	VALVE LOCATION IN RELATION TO PANEL
1	523 DT	6 in (152 mm), inboard; near top of tank.
3	626 BT	12 in (305 mm), aft; 24 in (610 mm) from top of tank.

Valve Location and Access Panels
Table 601

B. Check

(1) Check that the spring-loaded flap moves freely and fully; check that it seats by spring pressure.

(2) Check that there is no foreign matter on the valve flap or seat.

C. Conclusion

R (1) Refit the tank access panel as detailed in 57-00-00,
R Removal/Installation.

R (2) Remove the warning placards.

SCAVENGE NON-RETURN VALVE - REMOVAL/INSTALLATION

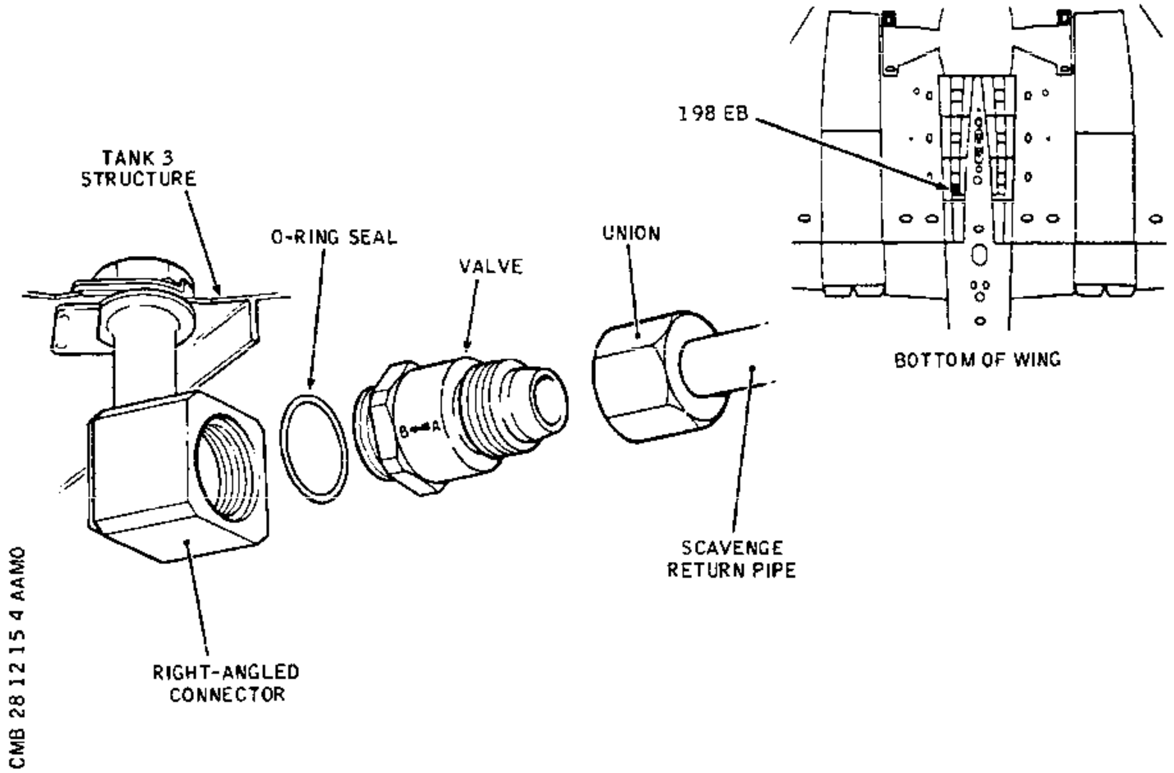
WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The scavenge non-return valve is mounted in the underwing fairing beneath No.3 collector tank. The outlet side of the valve is attached to the tank structure by a right-angled connector, and the inlet side of the valve is connected to the scavenge return pipe. An arrow on the valve body indicates the direction of flow through the valve. Access to the valve is gained by removing an access panel in the underwing fairing.

2. Scavenge Non-return Valve (Ref. Fig. 401)



Scavenge Non-return Valve - Installation
Figure 401

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Torque spanner, 650 lbf in (7.345 mdaN)	-

B. Prepare

(1) Defuel and drain tank 3 (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel door is shut. Place placards at the panels warning that the switch settings must not be altered.

(3) Electrically isolate the scavenge pump by tripping the following circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6

(4) Remove the access panel 198 EB.

C. Remove

(1) Disconnect the scavenge return pipe from the inlet side of the valve and fit a suitable blank to the pipe union.

(2) Support the right-angled connector, and remove the valve; fit a suitable blank to the connector.

(3) Remove and discard the O-ring seal from the valve

and fit suitable blanks to each end of the valve.

D. Install

(1) Observe the fuel and electrical safety precautions.

(2) Remove the blanks from the valve and connector. Check that the mating surfaces of the valve and connector are clean and undamaged, then fit a new O-ring seal, lubricated in accordance with 20-23-11, to the valve.

(3) Support the right-angled connector. Screw the valve into the connector, and torque-tighten it to 650 lbf in (7.345 mdaN).

(4) Remove the blank from the scavenge return pipe. Check that the mating surfaces of the valve and pipe are clean and undamaged, then connect the pipe to the valve. Support the right-angled connector and torque-tighten the pipe union nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

E. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Remove the warning placards from the panels.

(3) Carry out a Functional Test of the non-return valve (Ref. Adjustment/Test).

SCAVENGE NON-RETURN VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The scavenge non-return valve is mounted in the underwing fairing under tank 3, to prevent fuel in tank 3 flowing back into the scavenge tank.

Controls and indicators used in this test are on the fuel management panel at the third crew member's station.

This topic comprises a Functional Test which includes a check of the valve for both external and internal fuel leakage. Operational and System Tests are not applicable.

2. Functional Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing), and that the refuel control panel access door is closed.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Remove the access panel (Ref. Removal/Installation).

(4) On the fuel management panel, ensure that tank 2 fuel quantity is below high level to enable the standby inlet valve to be opened. Also ensure that the tank contains at least 1,000 kg of fuel.

(5) Ensure that tank 3 contains approximately 4,000 kg of fuel.

B. Test

(1) Set the tank 2 STANDBY INLET VALVE switch to "OPEN" and check that the associated magnetic indicator displays diagonal stripes and then bar-in-line.

(2) Set the TRIM PIPE DRAIN valves switch to "OPEN", and check that the associated magnetic indicators

display diagonal stripes and then OPEN.

(3) Observe that the SCAVENGE PUMP magnetic indicator displays ON.

(4) When the SCAVENGE PUMP indicator displays ON, check that there is no external leakage of fuel from the scavenge non-return valve.

(5) Allow the pump to operate for 5 min and check, by reference to the fuel quantity indicators, that at least 127 kg of fuel have been transferred from tank 2 to tank 3 during this period.

(6) Set the tank 2 STANDBY INLET VALVE switch to "SHUT" and check that the associated magnetic indicator displays bar-across-line.

(7) Set the TRIM PIPE DRAIN valves switch to "SHUT" and check that the associated magnetic indicators display SHUT.

(8) Observe that the SCAVENGE PUMP magnetic indicator displays OFF approximately 30 s after the trim pipe drain valves have shut.

(9) Check that the SCAVENGE PUMP indicator does not display ON again over a period of 5 min.
If it does revert to ON, this signifies internal leakage of the non-return valve, allowing fuel to flow from tank 3 to the scavenge tank.

C. Conclusion

(1) Refit the access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

BURSTING DISC - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig.401)

A bursting disc assembly located inside each of tanks 1, 2, 3, 4, 5, 6, 7, 8 and 10, is screwed to a stub pipe which, in turn, is connected to the main vent gallery. The bursting discs provide additional protection against fuel overpressure.

Two standards of disc are fitted, the differential bursting pressure for each standard being as follows:

For tanks 1, 2, 3 and 4: 4.38 to 5.35 psig (0.30 to 0.37 bar)

For tanks 5, 6, 7, 8 and 10: 5.69 to 6.95 psig (0.39 to 0.48 bar)

Design features preclude installation of a disc of the wrong standard.

To gain access to the discs, the appropriate tank must be drained and entered.

2. Bursting Disc

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Grease (Ref. 20-30-00, No.51)	-

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

B. Prepare

(1) Drain the appropriate tank (Ref. 28-25-00, Servicing).

(2) Remove the appropriate tank access panel and enter the tank as detailed in 28-10-00, Servicing.

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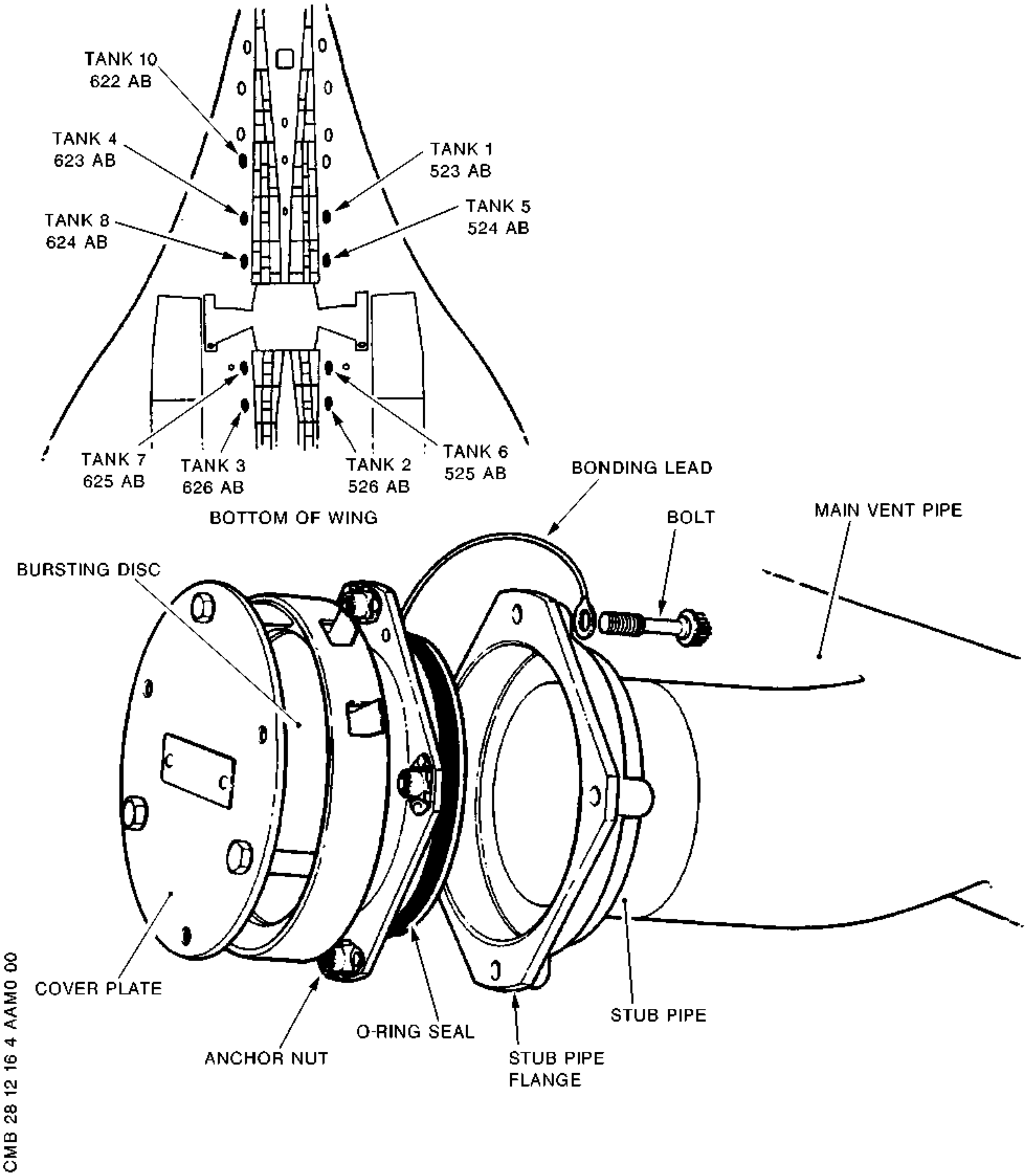

Bursting Disc - Installation
Figure 401

C. Remove

(1) Remove the four bolts, which secure the disc assembly to the stub pipe, and withdraw the disc assembly.

(2) Remove and discard the O-ring seal from the disc assembly.

(3) Fit a suitable blank to the open port of the vent stub pipe.

D. Install

(1) Observe the fuel safety precautions.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the bursting disc assembly.

(3) Remove the blank from the vent stub pipe and hold the assembly in position. Attach it, together with the bonding lead, to the stub pipe flange with the four bolts, torque-tightening each bolt evenly, in diametrically opposite sequence, to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(4) Check that the bonding is in accordance with 20-27-11.

E. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) Ensure that the mating surfaces of the tank and tank panel are clean and undamaged. Lightly coat the mating surfaces with grease, then fit and secure the panel to the tank.

R (3) Refuel the tank (Ref. 12-11-28).

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VENT INWARD RELIEF VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

There are two vent inward relief valves fitted to the aircraft. Each valve is mounted on the external face of the forward bulkhead of each wing cell of tank 9.

Access to the valves is gained by removing a wing leading edge panel at the forward wing root.

2. Vent Inward Relief Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-

B. Prepare

R B (1) Open the appropriate panels 511BB and 511AZ for the
R B left-hand valve or 611BB and 611AZ for the right-hand
R B valve.

C. Remove

(1) Remove the three bolts and washers securing the valve to the mounting on the tank bulkhead, noting the position of the bonding bolt, which has a dimpled head.

(2) Rotate the valve and withdraw it from the inlet pipe.

(3) Remove and discard the O-ring seals from the valve flange and the inlet pipe.

(4) Fit suitable blanks to the pipe apertures.

C. Install

(1) Remove the blanks from the pipe apertures.

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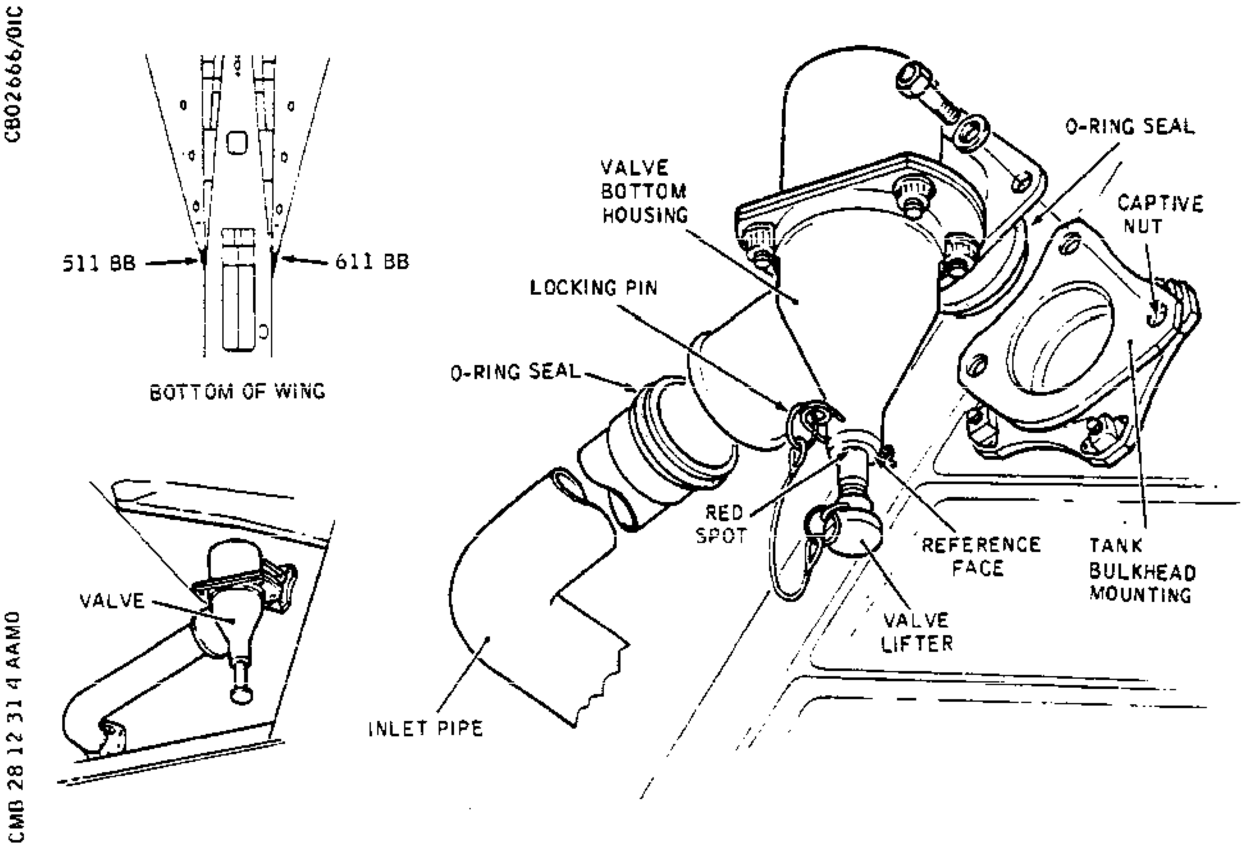

\- Vent Inward Relief Valve - Installation
Figure 401

(2) Ensure that the mating surfaces of the valve aperture, the tank mounting and the inlet pipe are clean and undamaged.

(3) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the valve flange and the inlet pipe.

(4) Position the valve to allow the inlet pipe to be inserted into the valve bottom housing.

(5) Rotate the valve into position against the tank mounting.

(6) Secure the valve to the tank mounting with the bolts and washers, ensuring that the bonding bolt is correctly positioned. Torque-tighten each bolt to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(7) Ensure that the electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Remove the locking pin and manually operate the valve by means of the valve lifter. Ensure that the valve closes on its seating when the lifter is released.

(2) Position the lifter so that the red spot is level with the reference face, and the locking pin holes are aligned. Refit the locking pin.

R B (3) Refit the access panels, 511BB and 511AZ or 611BB
R B and 611AZ, as appropriate

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VENT OVERPRESSURE PRESSURE SWITCH (OVERFLOW RELIEF VALVE) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

Two vent overpressure pressure switches are fitted, one in the right upper wing fillet and one in the rear fuselage underfloor equipment bay.

2. Vent Overpressure Pressure Switch (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque spanner, 40 to 45 lbf in (0.45 to 0.51 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN)	-

B. Prepare

(1) Electrically isolate the pressure switches by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, and fit a safety clip.

(2) Gain access to the appropriate pressure switch as follows:-

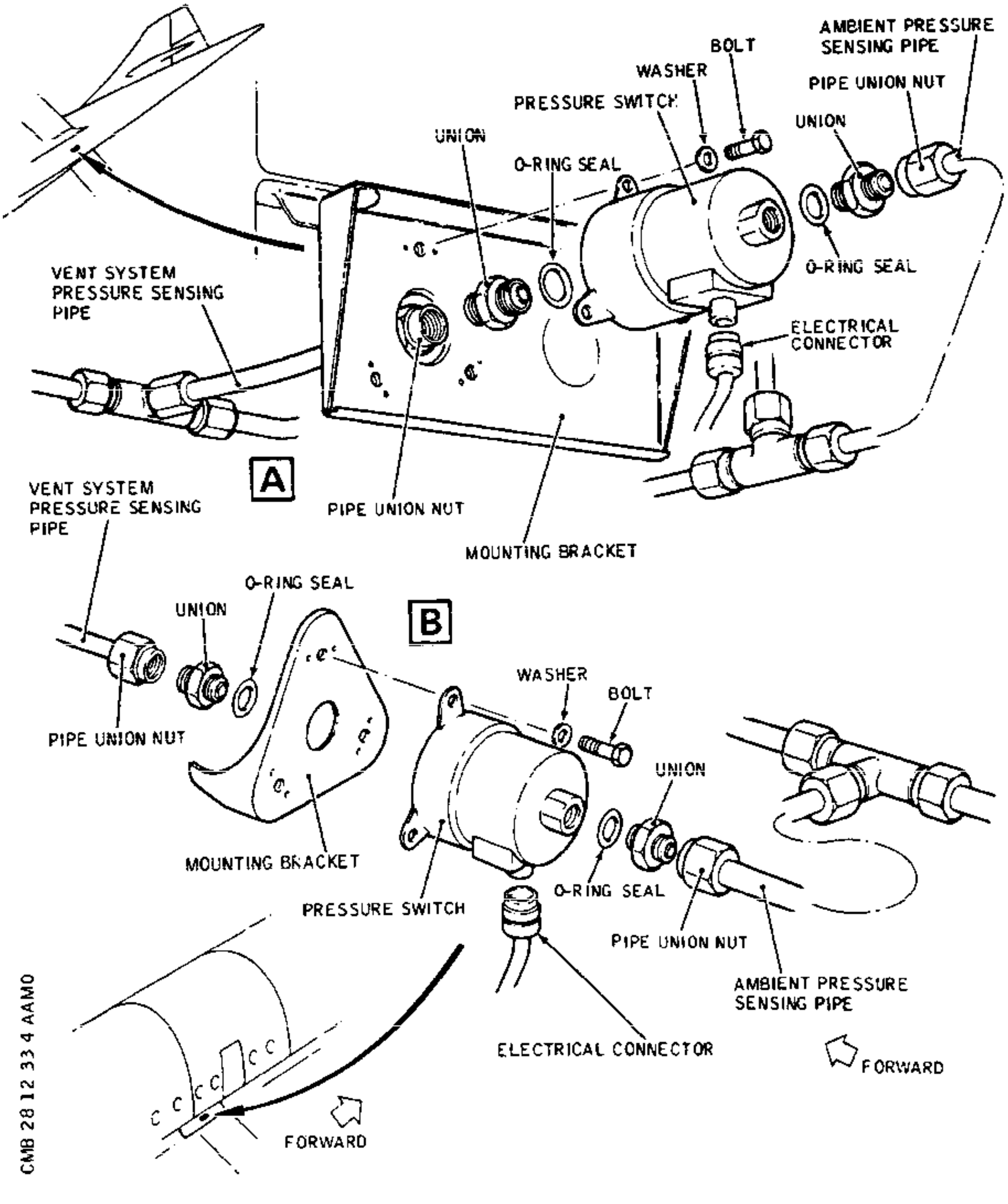
(a) Remove access panel 292 GT in the right upper wing fillet fairing (Detail B).

(b) Remove access panels 153 BB and 153 DB in the fuselage bottom skin (Detail A).

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the vent system and ambient pressure



- Vent Overpressure Pressure Switch - Installation
Figure 401

sensing pipes from the pressure switch.

(3) Remove the bolts and washers securing the pressure switch to the mounting bracket and remove the pressure switch.

(4) Remove the unions from the pressure switch and discard the O-ring seals.

(5) Fit suitable blanks to the pressure switch ports and the open pipe ends.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the pressure switch ports and the pipes.

(3) Lightly lubricate new O-ring seals with system fuel and fit an O-ring seal and union at each port of the pressure switch in accordance with 20-23-11; torque-tighten the unions to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(4) Position the pressure switch on the mounting bracket and secure it with the bolts; torque-tighten the bolts to between 40 and 45 lbf in (0.45 and 0.51 mdaN) in accordance with 20-21-11.

(5) Check that the pressure switch is electrically bonded in accordance with 20-27-11.

(6) Connect the pipes to the unions in accordance with 20-23-11 and torque-tighten the union nuts to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(7) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breaker tripped before removal.

(2) Perform a Functional Test of the pressure switch (Ref. Adjustment/Test).

(3) Refit the access panel removed to gain access to

the switch.

VENT OVERPRESSURE PRESSURE SWITCH (OVERFLOW RELIEF VALVE) - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

Two vent overpressure pressure switches are connected into the vent system, one located in the right upper wing fillet and one in the rear fuselage underfloor equipment bay. When the differential between the pressure in the the fuel tank and ambient pressure is 3.0 psi (0.207 bar), the pressure switches operate to open the vent overflow relief valve.

This topic comprises a Functional Test. Operational and System Tests are not considered necessary in this application.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a suction of -5 psig (-0.345 bar) and a pressure of 10 psig (0.689 bar)	-
Plug adapter, fuel vent ambient sense lines in tank 11	E925054
Communications set	-
Circuit breaker safety clip	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed

in 24-41-00.

(3) Establish communication between the flight compartment and the testing area.

(4) Remove access panels 292 GT in the right upper wing fillet fairing, and 153 BB and 153 DB in the fuselage bottom skin.

(5) Using a plug adapter, blank off the ambient sense line intake on one side of tank 11.

(6) Fit a plug adapter to the ambient sense line intake on the opposite side of tank 11 and connect to it the air supply rig.

(7) Electrically isolate the pressure switches by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, and fit a safety clip.

(8) Remove the electrical connector from the pressure switch (Q727) in the right upper wing fillet and reset the circuit breaker tripped in operation (7), above.

C. Test

(1) Perform the following test of the switch function:-

(a) Slowly apply a suction to the ambient sense line and check that the vent overpressure pressure switch in the rear fuselage underfloor
R equipment bay operates to open the overflow
R relief valve when the pressure is between
R -2.8 and -3.0 psig (0.193 and 0.207 bar).

(b) Slowly release the suction and check that the pressure switch operates to close the overflow relief valve when the pressure is between -2.0 and -2.5 psig (0.137 and 0.172 bar).

(c) Electrically isolate the pressure switches by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, and fit a safety clip.

(d) Connect the electrical connector to the pressure switch (Q727) and disconnect the electrical connector from the pressure switch (Q741) in the rear fuselage underfloor equipment

bay. Reset the circuit breaker tripped in operation (3), above.

R (e) Repeat operations (a) and (b), above, and check
R that the overflow relief valve opens and closes at the appropriate pressure settings.

(f) Trip the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 and connect the electrical connector to the pressure switch (Q741). Reset the circuit breaker.

(2) Perform the following leakage test:-

(a) Ensure that the ambient sense line drain valve is closed.

(b) Apply a pressure of 3 psig (0.207 bar) to the ambient sense line for a period of 5 min and check the pressure switch-to-pipe connection for freedom from leaks.

(c) Release the pressure on the ambient sense line and remove the air supply rig and plug adapter from the vent ambient sense line intake at one side of tank 11.

(d) Remove the plug adapter at the opposite side of tank 11.

(e) Perform a fluid leak test of the rear pressure switch (Q741) connection to the pressure sense line as detailed for single pipe replacement (Ref. 28-12-00, Adjustment/Test, Pipes in Dry Bays).

NOTE: Because it is not practicable to test the forward pressure switch (Q727), using the fluid leak test, the correct assembly and torque-tightening of the connector must be ensured (Ref. Removal/Installation).

E. Conclusion

(1) Refit the access panels 292 GT in the right upper wing fillet fairing, and 153 BB and 153 DB in the fuselage bottom skin.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

VENT SHUT-OFF VALVES AND PRESSURE CONTROL VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

LIGHT REACHING THE DETECTOR UNIT OF THE FUEL VENT EXPLOSION SUPPRESSION SYSTEM COULD INITIATE OPERATION OF THE SYSTEM. BEFORE REMOVING COMPONENTS OR DISCONNECTING PIPING OF THE FUEL VENT SYSTEM, IT IS IMPERATIVE THAT THE FUEL VENT EXPLOSION SUPPRESSION SYSTEM BE ELECTRICALLY ISOLATED BY REMOVING THE FUSE FROM THE TOP OF THE SUPPRESSOR IN THE FIN AS DETAILED IN 26-31-12, REMOVAL/INSTALLATION.

1. General

The vent shut-off valves are two electrically operated butterfly valves mounted in the tail cone to isolate the main vent gallery above 44,000 ft. The pressure control valve is mounted on a branch pipe parallel with the RH vent shut-off valve and is spring-loaded to relieve pressure build-up in the vent system if all outlets are closed.

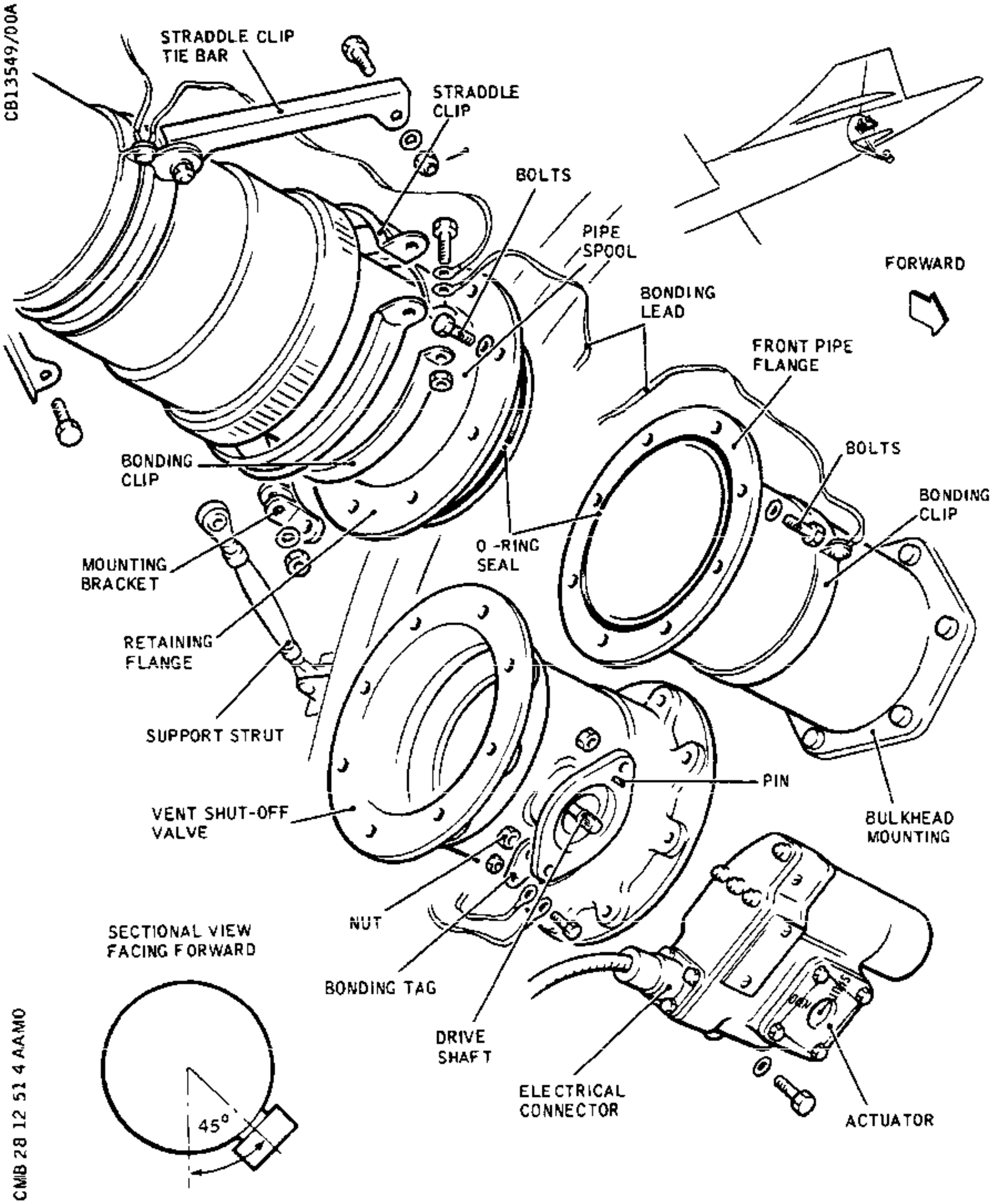
Access to all valves is through the tail wheel doors in the tail cone. Each valve is provided with a spool attachment which allows the valve to be removed without disturbing its associated piping. The actuator on a vent shut-off valve may be removed without disturbing the valve and the removal/installation procedure is applicable to the actuators of both valves.

2. Vent Shut-off Valve Actuator (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-

B. Prepare



R – Vent Shut-off Valve (LH) - Installation
Figure 401

(1) Ensure that the tail landing gear is lowered.

(2) Trip the following circuit breakers and fit safety clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16
RH VENT VALVE SUP	3-213	Q723	D7
LH VENT VALVE SUP	1-213	Q722	K16

(3) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove

(1) Disconnect the electrical connector from the actuator.

(2) Remove the electrical bonding leads which are attached to the bonding tag on the actuator securing bolt.

(3) Remove the two bolts and self-locking nuts which secure the actuator to the valve flange.

(4) Withdraw the actuator from the valve, noting the position of the master splines on the output shaft and drive shaft.

D. Install

(1) Comply with the electrical safety precautions.

(2) Fit the actuator to the mounting flange on the valve, ensuring that the master splines on the output shaft and drive shaft engage correctly and that the pin is located in the hole in the actuator flange.

(3) Secure the actuator to the valve with bolts and self-locking nuts, ensuring that the bonding tag is correctly positioned. Torque-tighten each nut to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(4) Attach the electrical bonding leads to the bonding tag, checking that the bonding is in accordance with 20-27-11.

(5) Connect the electrical connector to the actuator, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(2) Remove the safety clips and reset the circuit breakers tripped before removal.

(3) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

3. Vent Shut-off Valve (LH) (Ref. Fig.401 and 404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
Torque spanner, 50 to 60 lbf in (0.57 to 0.68 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.14 to 0.17 mdaN)	-

B. Prepare

(1) Ensure that the tail landing gear is lowered.

(2) Trip the following circuit breakers and fit safety clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16
LH VENT VALVE SUP	1-213	Q722	K16
FUEL VENT IGN PROTN SYS SUP	1-213	W501	P21

(3) Remove the fuse from the top of the suppressor in the fin as detailed in 26-31-12, Removal/ Installation.

(4) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove

NOTE: The LH vent valve installation is different from that of the RH valve in that the rear end of the LH valve is connected to a longer spool which is joined to the rear pipe section by means of a straddle clip assembly.

(1) Disconnect the electrical connector from the actuator.

(2) Remove the bolts attaching the straddle clip tie-bar to the straddle clips; remove the clips.

(3) Remove the electrical bonding leads attached to the valve and the bonding lead and clip attached to the spool.

(4) Remove the bolts connecting the two support struts to their mounting brackets on the retaining flange.

(5) Remove the bolts securing the spool retaining flange to the valve and remove the support strut mounting brackets.

(6) Draw the spool rearward together with the loose retaining flange.

(7) Remove the bolts from the front pipe flange.

(8) Draw the valve slightly rearward, until it is clear of the front pipe, and remove it. Remove and discard the O-ring seals from the spool and the front pipe.

(9) Fit suitable blanks to both ends of the valve and also to the spool and the front pipe section.

D. Install

CAUTION: CORRECT ORIENTATION OF THE VALVE DURING INSTALLATION IS MOST IMPORTANT. THE ARROW ON THE VALVE BODY MUST POINT FORWARD TOWARD TANK 11. THE ELECTRICAL CONNECTOR WILL THEN FACE REARWARD AND THE VALVE MUST BE ORIENTATED SO THAT THE ACTUATOR FACES INWARD AND DOWNWARD, AT AN ANGLE OF 45 deg FROM HORIZONTAL.

(1) Comply with the electrical safety precautions.

(2) Remove the blanks from both ends of the valve and also from the spool and the front pipe section.

(3) Check that the mating surfaces of the valve, spool and front pipe section are clean and undamaged. Fit new O-ring seals, lubricated in clean fuel, to the spool and the front pipe.

(4) Retract the spool into the ducting and place the valve in position against the front pipe flange.

(5) Bolt the valve to the front pipe flange and torque-tighten each bolt to between 60 and 70 lbf in (0.68 and 0.79 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(6) Draw the spool forward into the valve. Bolt the valve to the retaining flange with the support strut mounting brackets correctly positioned; torque-tighten each bolt to between 60 and 70 lbf in (0.68 and 0.79 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(7) Bolt the two support struts to their mounting brackets and torque-tighten the nuts to between 50 and 60 lbf in (0.57 and 0.68 mdaN). Lock the nuts with split pins in accordance with 20-21-12.

(8) Connect the electrical bonding leads to the valve and bolt the bonding leads and clip to the spool, checking that the bonding is in accordance with 20-27-11.

(9) Secure the straddle clip tie-bars to the straddle clips. Check that the spool insertion into the pipe and valve meets the dimensional requirements (Ref. Fig. 404). Torque-tighten the nuts to between 12 and 15 lbf in (0.14 and 0.17 mdaN). Lock the nuts with split pins in accordance with 20-21-12.

(10) Connect the electrical connector to the actuator, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(2) Replace the fuse on the top of the suppressor as detailed in 26-31-12, Removal/Installation and carry out an Operational Test as detailed in 26-31-12, Adjustment/Test.

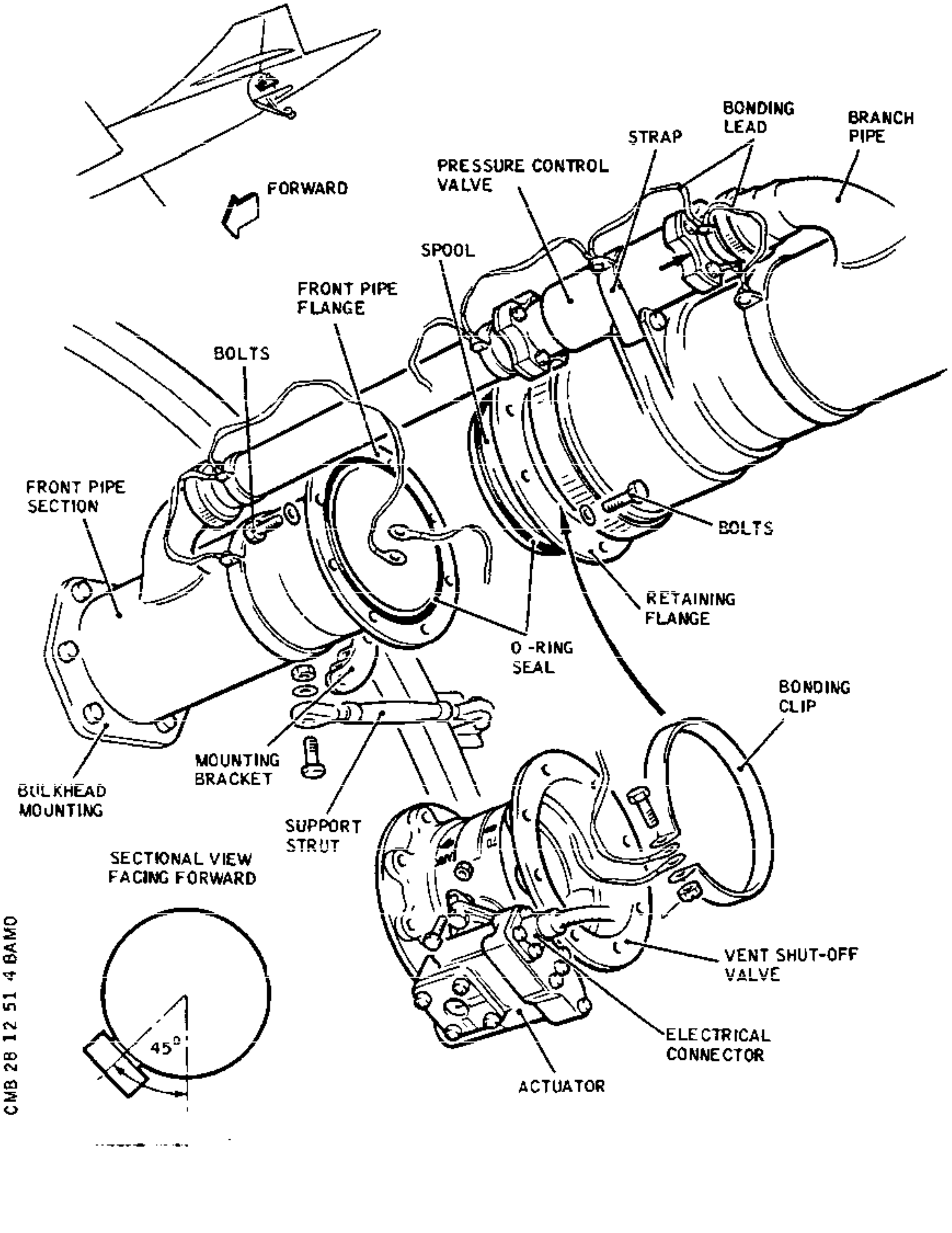
(3) Remove the safety clips and reset the circuit breakers tripped before removal.

(4) Carry out a Functional Test of the valve and a Leakage Test of the piping and connections (Ref. Adjustment/ Test).

4. Vent Shut-off Valve (RH) (Ref. Fig.402 and 404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
Torque spanner, 50 to 60 lbf in (0.57 to 0.68 mdaN)	-



Vent Shut-off Valve (RH) - Installation
Figure 402

B. Prepare

(1) Ensure that the tail landing gear is lowered.

(2) Trip the following circuit breakers and fit safety clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16
RH VENT VALVE SUP	3-213	Q723	D7
FUEL VENT IGN PROTN SYS SUP	1-213	W501	P21

(3) Remove the fuse from the top of the suppressor in the fin as detailed in 26-31-12, Removal/ Installation.

(4) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove

(1) Disconnect the electrical connector from the actuator.

(2) Remove the electrical bonding leads attached to the valve and the bonding lead and clip attached to the spool.

(3) Remove the bolts securing the valve to the retaining flange and draw the spool rearward, together with the loose retaining flange.

(4) Remove the bolts connecting the two support struts to their mounting brackets on the front pipe flange.

(5) Remove the bolts and the two mounting brackets from the front pipe flange.

(6) Draw the valve slightly rearward, until it is clear of the front pipe, and remove it. Remove and discard the O-ring seals from the spool and the front pipe.

(7) Fit suitable blanks to both ends of the valve and also to the spool and the front pipe section.

D. Install

<u>CAUTION</u>: CORRECT ORIENTATION OF THE VALVE DURING INSTALLATION IS MOST IMPORTANT. THE ARROW ON THE VALVE BODY MUST POINT FORWARD TOWARD TANK 11. THE ELECTRICAL CONNECTOR WILL THEN FACE REARWARD AND THE VALVE MUST BE ORIENTATED SO THAT THE ACTUATOR FACES INWARD AND DOWNWARD AT AN ANGLE OF 45 deg FROM HORIZONTAL.

(1) Comply with the electrical safety precautions.

(2) Remove the blanks from both ends of the valve and also from the spool and the front pipe section.

(3) Check that the mating surfaces of the valve, spool and front pipe section are clean and undamaged. Fit new O-ring seals, lubricated in clean fuel, to the spool and the front pipe.

(4) Retract the spool into the ducting and place the valve in position against the front pipe flange.

(5) Bolt the valve to the front pipe flange with the support strut mounting brackets correctly positioned; torque-tighten each bolt to between 60 and 70 lbf in (0.68 and 0.79 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(6) Bolt the support struts to the mounting brackets and torque-tighten the nuts to between 50 and 60 lbf in (0.57 and 0.68 mdaN). Lock the nuts with split pins in accordance with 20-21-12.

(7) Draw the spool forward into the valve. Check that the spool insertion into the pipe and valve meets the dimensional requirements (Ref. Fig. 404). Secure the retaining flange to the valve with the bolts and torque-tighten each bolt to between 60 and 70 lbf in (0.68 and 0.79 mdaN). Wire-lock the

bolts in accordance with 20-21-13.

(8) Connect the electrical bonding leads to the valve and bolt the bonding leads and clip to the spool, checking that the bonding is in accordance with 20-27-11.

(9) Connect the electrical connector to the actuator, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the tail landing gear jack locking sleeve.

(2) Replace the fuse on the top of the suppressor as detailed in 26-31-12, Removal/Installation and carry out an Operational Test as detailed in 26-31-12, Adjustment/Test.

(3) Remove the safety clips and reset the circuit breakers which were tripped before removal.

(4) Carry out a Functional Test of the valve and a Leakage Test of the piping and connections (Ref. Adjustment/Test).

5. Pressure Control Valve (Ref. Fig.403 and 404)

A. Equipment and Materials

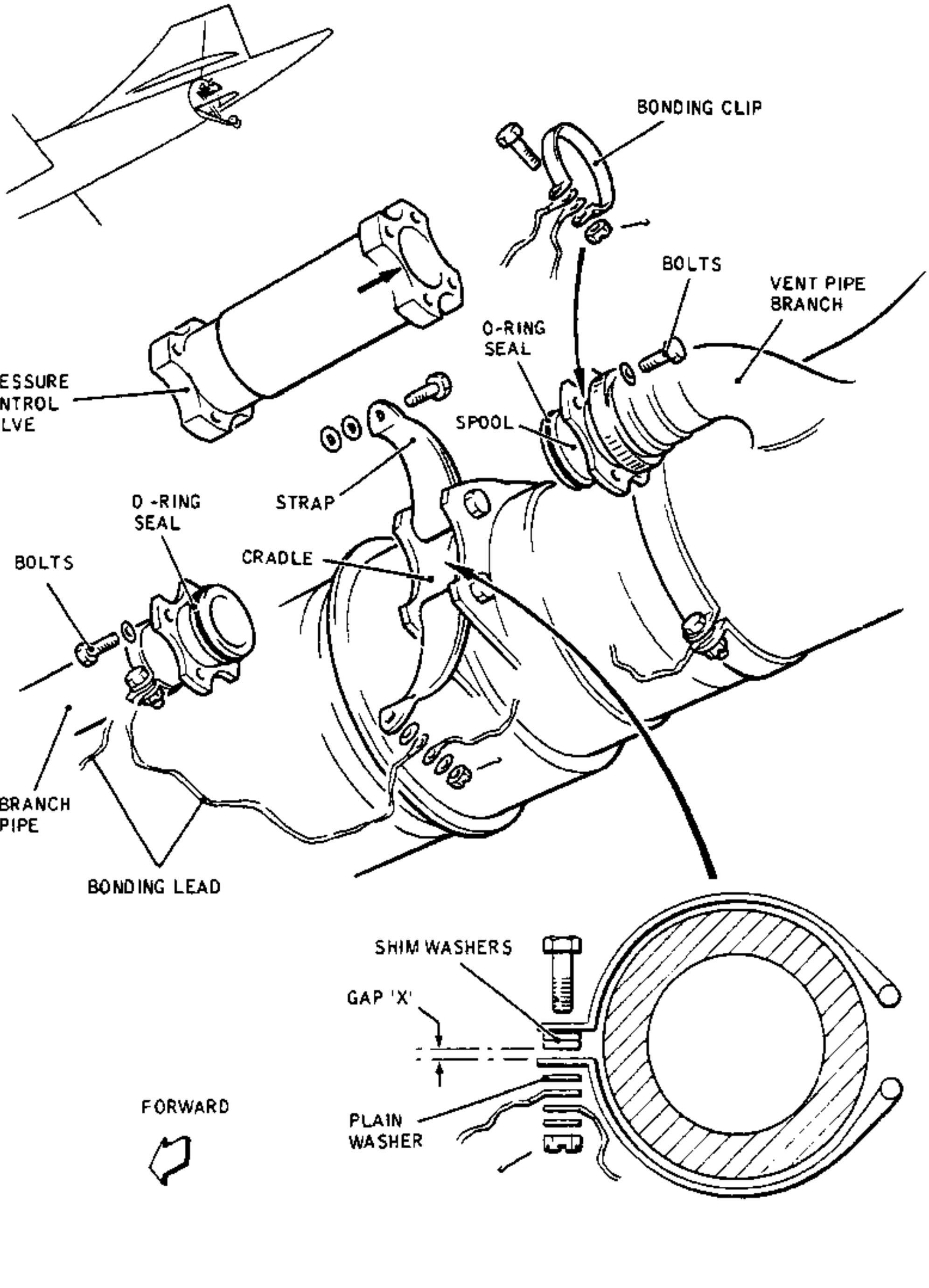
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
Torque spanner, 12 to 15 lbf in (0.14 to 0.17 mdaN)	-

B. Prepare

(1) Ensure that the tail landing gear is lowered.

(2) Trip the following circuit breakers and fit safety

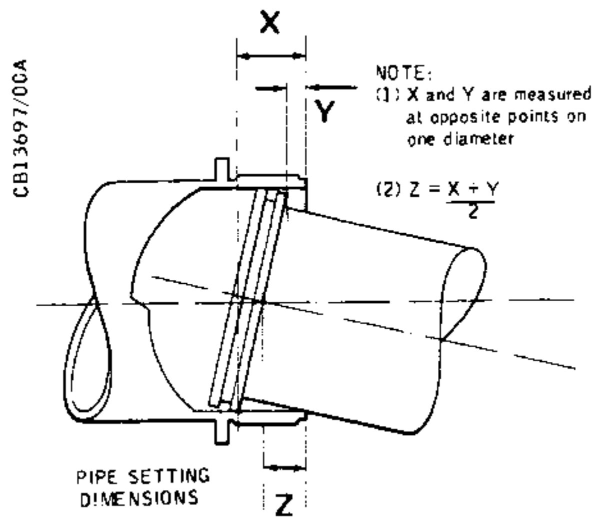
CB13550/00A



CMB 28 12 51 4 CAMO

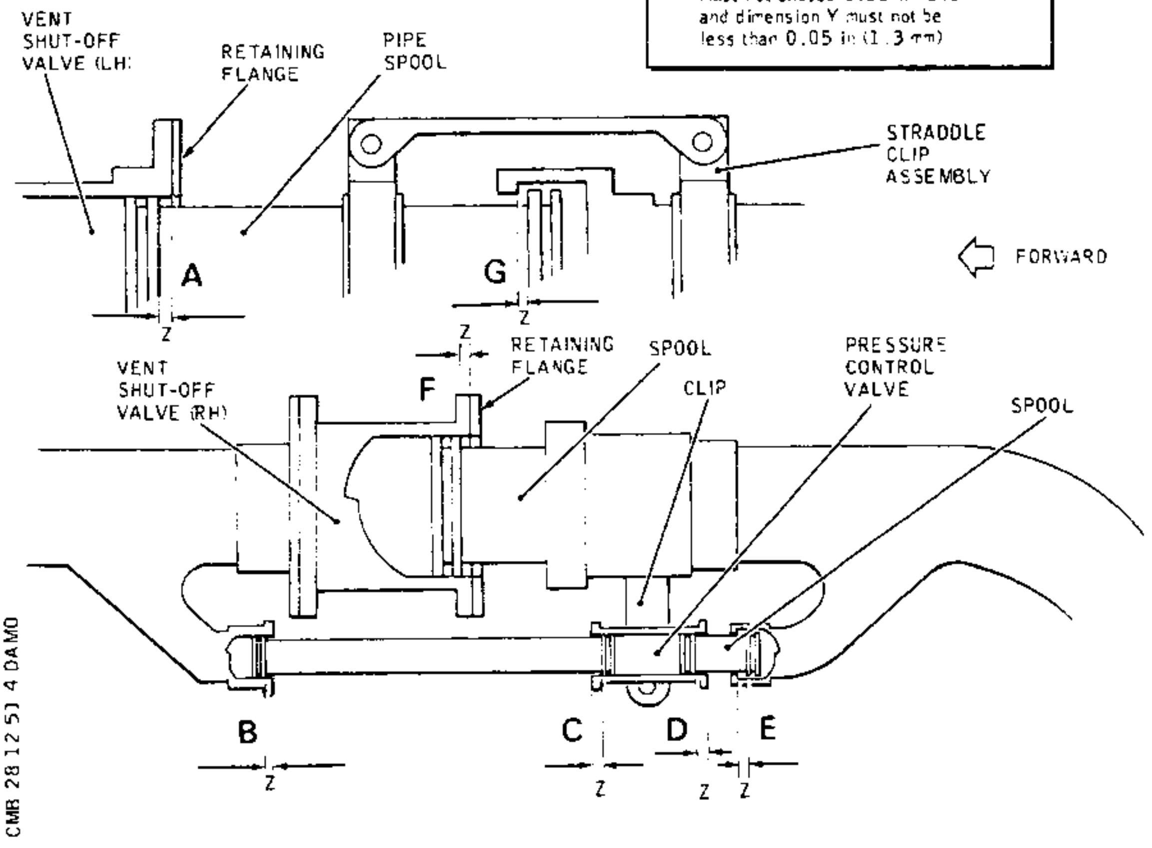
Pressure Control Valve - Installation
Figure 403

R



JOINT	INSERTION DIMENSION Z	
	in	mm
A	0.2 (±0.05)	5.1 (±1.3)
B	0.2 (+0.10 / -0.05)	5.1 (+2.5 / -1.3)
C D F	0.2 (±0.02)	5.1 (±0.5)
E	0.2 (±0.15)	5.1 (±3.8)

NOTE:
At joint **G**, dimension X minus Y must not exceed 0.15 in (3.8 mm) and dimension Y must not be less than 0.05 in (1.3 mm)



R - Pipe Setting Dimensional Requirements
Figure 404

clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16
FUEL VENT IGN PROTN SYS SUP	1-213	W501	P21

(3) Remove the fuse from the top of the suppressor in the fin as detailed in 26-31-12, Removal/ Installation.

(4) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove

(1) Remove the electrical bonding leads and clip from the spool at the rear end of the valve.

(2) Remove the bolts securing the rear end of the valve and slide the spool rearward. Remove and discard the O-ring seal from the groove in the spool.

(3) Remove the bolts securing the front end of the valve and slide the front section of the branch pipe gently forward until clear of the valve. Remove and discard the O-ring seal from the groove in the branch pipe.

(4) Remove the bolt and the bonding leads from the strap which secures the valve to the vent pipe bracket. Note the number and position of the washers on the strap assembly. Draw the valve clear of its associated piping.

(5) Fit suitable blanks to both ends of the valve and also to the spool and the front section of the branch pipe.

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D. Install

NOTE: The correct orientation of the valve during installation is ensured because its flanges are different in size. The larger flange faces rearward and an arrow on the valve body points in this direction.

(1) Remove the blanks from both ends of the valve and also from the spool and the front section of the branch pipe.

(2) Manually check the valve for full and free function.

(3) Check that the mating surfaces of the valve, spool and branch pipe are clean and undamaged, then fit new O-ring seals, lubricated in clean fuel, to the spool and the branch pipe.

(4) Place the valve in the cradle on the vent pipe, the larger flange facing rearward, and assemble the securing strap and shim washers, together with the bonding leads, to achieve a grip allowance (gap 'X') of between 0.010 and 0.020 in (0.25 and 0.50 mm). Tighten just sufficiently to retain the valve at this stage.

(5) Draw the spool and branch pipe into the valve and locate the latter axially so that the pipe insertions meet the dimensional requirements (Ref. Fig. 404). Torque-tighten the nut on the securing strap to between 12 and 15 lbf in (0.14 and 0.17 mdaN) and lock it with a split pin in accordance with 20-21-12.

(6) Secure the pipe and spool retaining flanges to the valve with the bolts and torque-tighten each bolt to between 60 and 70 lbf in (0.68 and 0.79 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(7) Connect the electrical bonding leads and clip to the spool, checking that the bonding is in accordance with 20-27-11.

E. Conclusion

(1) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(2) Replace the fuse on the top of the suppressor

as detailed in 26-31-12, Removal/Installation and carry out an Operational Test as detailed in 26-31-12, Adjustment/Test.

(3) Remove the safety clips and reset the circuit breakers tripped before removal.

(4) Carry out a Functional Test of the valve and a Leakage Test of the piping and connections (Ref. Adjustment/Test).

VENT SHUT-OFF VALVES AND PRESSURE CONTROL VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two electrically-actuated vent shut-off valves are mounted on the tail cone forward bulkhead; they are controlled by the vent absolute pressure switches, to isolate the main gallery from ambient atmosphere above 44,000 ft. A pressure control valve, in a branch of the vent piping immediately inboard of the right-hand shut-off valve, is spring-loaded to the closed position and is opened by vent system pressure.

This topic comprises a Functional Test of a vent shut-off valve (applicable to both left-hand and right-hand installations), a Functional Test of the pressure control valve and a Leakage Test covering both types of valve and the associated pipe connections.

Operational and System Tests are not applicable to this topic.

2. Functional Test - Vent Shut-off Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a suction of -5 psig (-0.345 bar)	-
Circuit breaker safety clips	-

B. Prepare (Ref. Fig. 501)

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Ensure that the tail landing gear is lowered.

(3) Trip the circuit breakers listed below, and fit

safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

(4) Make available electrical ground power as detailed in 24-41-00.

(5) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(6) Ensure that the visual indicators on the valves show OPEN.

(7) Disconnect the sense line from the associated vent absolute pressure switch and connect the air supply rig to the pressure switch.

R (8) Open the refuel control panel access door.

C. Test

(1) Slowly apply a suction of between -2.05 and -2.65 psi (-0.141 and -0.183 bar), and check that -

(a) the vent valve shuts,

(b) the associated caption on the refuel control panel is illuminated, and

(c) the visual indicator on the valve shows SHUT.

(2) Slowly release the suction and check that -

(a) the vent valve opens as the pressure rises above -2.05 psig (-0.141 bar),

(b) the associated caption on the refuel control panel is extinguished, and

(c) the visual indicator on the valve shows OPEN.

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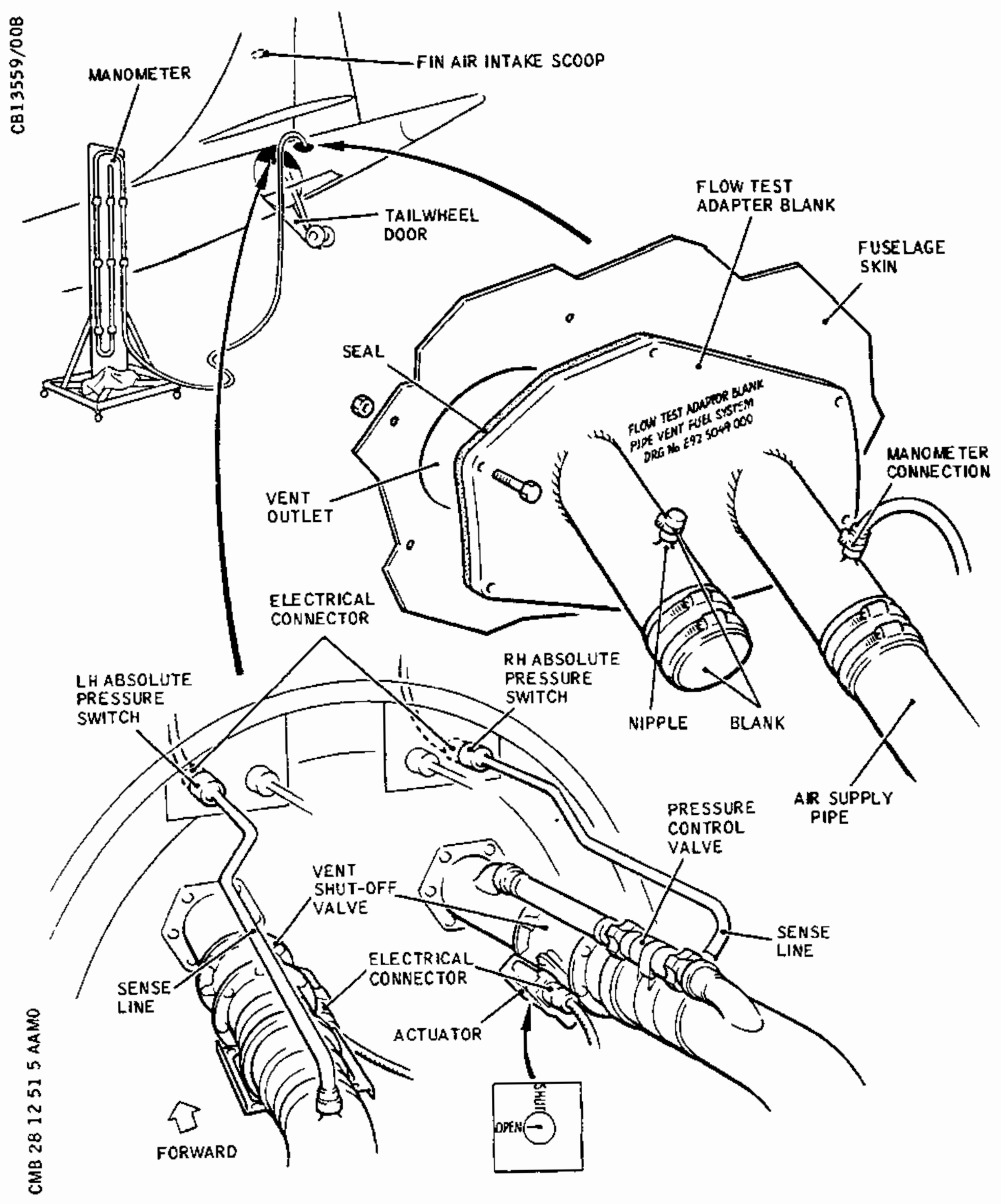


- Test Equipment - Installation
R Figure 501

D. Conclusion

(1) Disconnect the air supply rig, and reconnect the sense line to the vent absolute pressure switch.

(2) Remove the tail landing gear jack locking sleeve.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(4) Close the refuel control panel access door.

(5) Remove the safety clips and reset the circuit breakers tripped before the test.

3. Functional Test - Pressure Control Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a suction of -5 psi (-0.345 bar)	-
Vent pipe flow test adapter	E925049000
Circuit breaker safety clips	-

B. Prepare (Ref. Fig. 501)

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Ensure that the tail landing gear is lowered.

(3) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS	15-215	G1	A6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
CLOSE SUP			
UC POSN IND	1-213	G51	N16

(4) Make available electrical ground power as detailed in 24-41-00.

(5) Fit the locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

R (6) Fit the flow test adapter blank to the vent outlets as follows:-

(a) Remove the six nuts and countersunk bolts from the fuselage skin surrounding the vent outlets.

(b) Secure the blank, with its associated seal, to the vent outlets, using the adapter blank bolts and nuts and the holes from which the countersunk bolts were removed.

R (7) Disconnect the sense line from the RH vent absolute pressure switch and connect the air supply rig to the pressure switch. Slowly apply a suction until the RH vent shut-off valve closes. Maintain the suction.

R (8) Fit a suitable blank to the absolute pressure switch sense line.

(9) Connect the air supply rig to the nipple on the RH adapter tube. Fit suitable blanks to the outlet pipes of the adapter and to the other nipple.

C. Test

(1) Using the air supply rig, create a suction and check that the pressure control valve begins to open, as indicated by the pressure gauge on the supply rig, at -1.55 psig (-0.107 bar) and then controls at between -1.55 and -1.75 psig (-0.107 and -0.110 bar).

D. Conclusion

(1) Release the suction on the RH adapter tube and disconnect the air supply rig.

(2) Release the suction on the vent absolute pressure switch and check that the RH vent shut-off valve opens, then disconnect the air supply rig from the absolute pressure switch; reconnect the sense line to the pressure switch.

(3) Remove the test adapter blank from the vent pipe outlets. Replace the bolts and nuts removed from the fuselage skin before the test and torque-tighten the nuts to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(4) Remove the tail landing gear jack locking sleeve.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(6) Remove the safety clips and reset the circuit breakers previously tripped.

4. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a pressure of +10 psig (+0.690 bar)	-
Fuel manometer	-
Flow test adapter blank	E925049000
Air intake plug	E935055000
Soap solution	-
SNOOP or	
R (Ref. 20-30-00, No.195)	
SHERLOCK	
R (Ref. 20-30-00, No.196)	
Brush, for application of soap solution	-

DESCRIPTION	PART NO.
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
Circuit breaker safety clips	-

B. Prepare

(1) Ensure that the tail landing gear is lowered.

(2) Ensure that all fuel management panel switches and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place placards on both panels warning that the position of the switches must not be changed.

(3) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

(4) Fit the locking sleeve to the tail landing gear jack (Ref.12-37-00, Tail Gear Wheel).

(5) Fit the flow test adapter blank to the vent outlets as follows:-

(a) Remove the six nuts and countersunk bolts from the fuselage skin surrounding the vent outlets.

(b) Secure the blank, with its associated seal, to the vent outlets, using the adapter blank bolts and nuts and the holes from which the countersunk bolts were removed.

(c) Fit suitable blanks to one blank outlet pipe and nipple.

(6) Connect the air supply rig and fuel manometer to the other blank outlet pipe (Ref. Fig. 501). Set the manometer to release the pressure at 4.0 psig (0.276 bar).

(7) Fit the air intake plug to the air intake scoop on the RH side of the fin.

C. Test

CAUTION: THE AIR PRESSURE APPLIED DURING THIS TEST MUST NOT EXCEED 4 psig (0.276 bar).

(1) Using the air supply rig, slowly apply a pressure up to a maximum of 2 psig (0.138 bar), to pressurize the wing and vent system.

(2) Check, using a soap solution in accordance with 20-23-12, for any external leakage at the disturbed pipe and valve connections, for a minimum period of 15 min.

D. Conclusion

(1) Release the air pressure and disconnect the air supply rig. Remove the plug from the scoop in the fin.

(2) Disconnect the fuel manometer.

(3) Remove the flow test adapter blank from the vent pipe outlets. Replace the bolts and nuts removed from the fuselage skin before the test and torque-tighten the nuts to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(4) Remove the tail landing gear jack locking sleeve.

(5) Remove the safety clips and reset the circuit breakers previously tripped. Remove the warning placards.

5. Integrity Check - Vent Shut-off Valve Butterfly

B (1) Remove vent shut-off valve (LH or RH) in accordance with
B MM28-12-51 P/B 400 except do not fit blanks to valve.

B (2) Inspect butterfly for integrity with special regard to

B loose rivets, de-lamination of the butterfly plates, and
B cracks around the drive boss.

B (3) Reconnect electrical connector and suitably support valve.

B CAUTION: DO NOT TOUCH BUTTERFLY OR PLACE FINGERS INSIDE
B BORE OF VALVE BEFORE COMPLETION OF STEP (6).

B (4) Re-instate appropriate vent valve circuit breaker:

B L.H. VENT VALVE: PANEL 1-213, C/B Q722, MAP REF.K16

B R.H. VENT VALVE: PANEL 3-213, C/B Q723, MAP REF.D7

B (5) Operate vent valve by temporarily placing a jumper lead
B across the following test points:

B L.H. VENT VALVE: RELAY BOX 15-123, UT 1851-12B TO
B UT 1851-2D
B R.H. VENT VALVE: RELAY BOX 18-123, UT 1854-3B TO
B UT 1852-2D

B Observe that butterfly operates from fully OPEN to fully
B SHUT and back again.

B (6) Trip appropriate vent valve circuit breaker (See step 4),
B and fit safety clip.

B (7) Refit vent valve in accordance with MM 28-12-51 P/B 400.

OVERFLOW RELIEF VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This motorized valve is connected to the fuel overflow pipe to control fuel overflow from the scavenge tank. Access to the valve is gained by removing the appropriate access panel in the underside of the rear fuselage. The overflow pipe must be removed prior to removal of the valve.

This topic comprises separate removal/installation procedures for (a) the overflow pipe, (b) the valve, complete with motor, and (c) the motor itself, which may be removed with the valve in situ.

2. Overflow Pipe (Ref. Fig. 401)

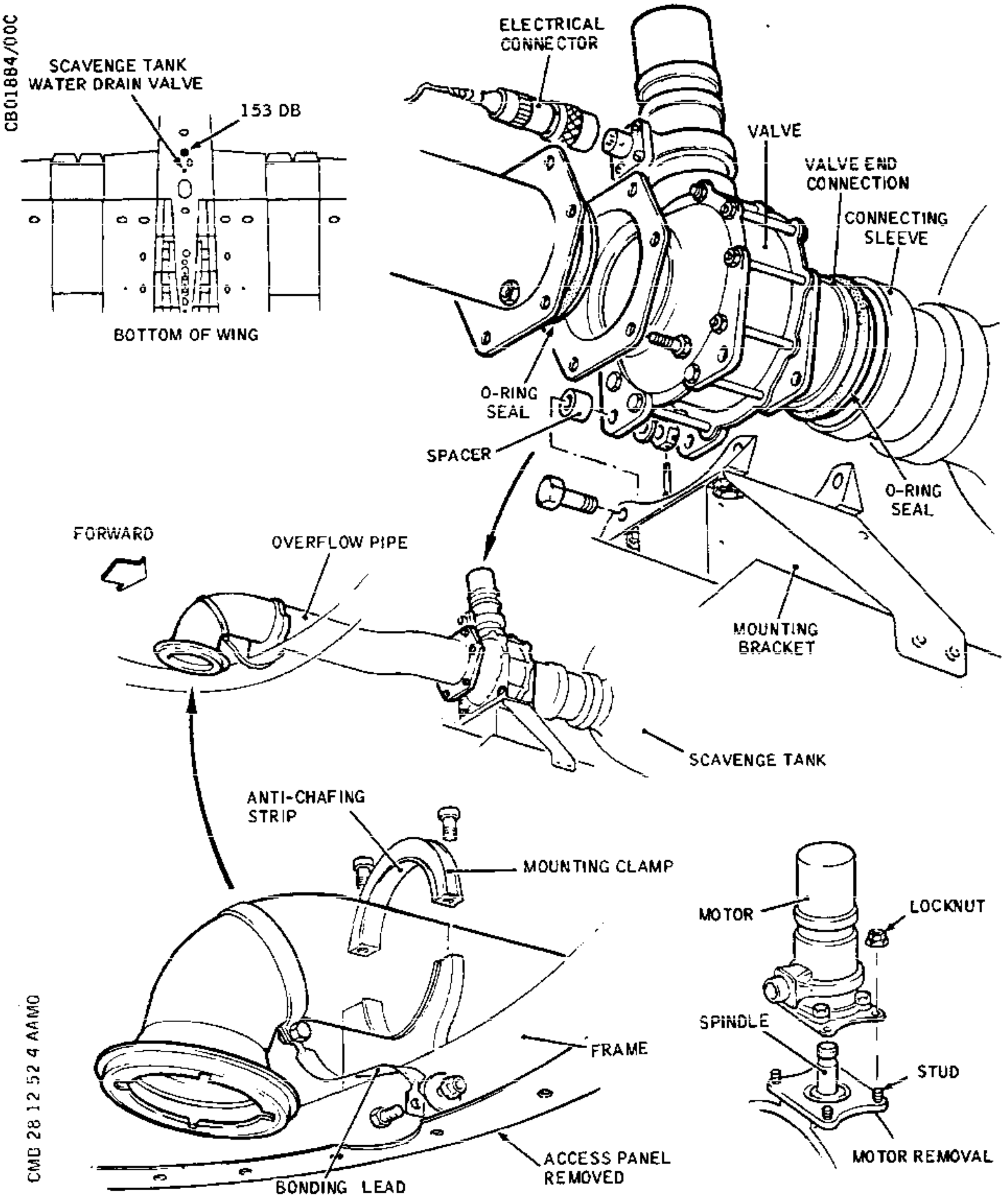
A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Fuel drain valve tool	D925374000
Receptacle, for fuel drainage	-
Torque spanner, 30 to 40 lbf in (0.339 to 0.452 mdaN)	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-

B. Prepare to Remove Pipe

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are



- Overflow Relief Valve - Installation
R Figure 401

at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(3) Ensure that the scavenge pump magnetic indicator displays OFF and the trim pipe drain valves magnetic indicators display SHUT.

(4) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OVERFLOW RELIEF VALVE SUP & IND	Q721	1-213	K15
TRIM PIPE DRAIN VALVES SUP & IND	Q701	15-215	G22

(5) Remove the access panel 153 DB.

(6) Drain any residual fuel (approximately 1 gal (4.55 l)) from the scavenge tank into a suitable receptacle by opening the scavenge tank water drain valve, using the fuel drain tool.

C. Remove Pipe

(1) Remove the nut and bolt securing the bonding lead to the lug on the fuselage frame. Tape the lead to the pipe away from the working area.

(2) Remove the bolts securing the top and bottom halves of the overflow pipe mounting clamp. Remove the top half together with the anti-chafing strip.

(3) Remove the nuts and bolts securing the overflow pipe to the valve. Remove the overflow pipe. Remove and discard the O-ring seal from the pipe flange and fit suitable blanks to the pipe and valve flanges.

(4) Remove the anti-chafing strip from the bottom half of the pipe mounting clamp.

D. Install Pipe

(1) Comply with the fuel and electrical safety precautions.

(2) Ensure that the mounting clamp anti-chafing strips are undamaged. Place the bottom strip in position.

(3) Remove the blanks from the overflow pipe and valve flanges and ensure that the mating surfaces are clean and undamaged. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the pipe flange.

(4) Place the pipe in the mounting clamp and align the pipe and valve flanges. Secure the pipe to the valve with bolts and nuts. Torque-tighten each nut to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

(5) Place the top anti-chafing strip in position and secure the top half of the mounting clamp to the bottom half with bolts. Torque-tighten each bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(6) Secure the bonding lead on the aft end of the pipe to the fuselage frame with a bolt and nut. Torque-tighten the nut to between 30 and 40 lbf in (0.339 and 0.452 mdaN).

(7) Ensure that all electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Fit the access panel 153 DB.

(2) Remove the safety clips and reset the circuit breakers previously tripped.

(3) Remove the warning placard from the fuel management panel.

(4) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

3. Overflow Relief Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.

DESCRIPTION	PART NO.
R Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-

B. Prepare to Remove Valve

(1) Remove the overflow pipe (Ref. para.2.).

C. Remove Valve

(1) Disconnect the electrical connector from the valve motor.

(2) Remove the split pins, nuts, washers, bolts and spacers securing the valve to the mounting bracket.

(3) Rotate the valve slightly clockwise until it clears the mounting bracket, then remove the valve by withdrawing it from the connecting sleeve on the scavenge tank.

(4) Remove and discard the O-ring seal from the valve end connection and fit suitable blanks to the valve and the connecting sleeve.

D. Install Valve

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the valve end connection and connecting sleeve. Check that the mating surfaces of the valve and the connecting sleeve are clean and undamaged, then fit a new O-ring seal, lubricated in accordance with 20-23-11, to the valve end connection.

(3) Insert the valve end connection into the connecting sleeve.

NOTE: When the valve is being fitted to the connecting sleeve it must be angled slightly to the right to clear the mounting bracket.

(4) Align the valve with the mounting bracket and secure it with bolts, spacers, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282

and 0.339 mdaN) and lock it with a split pin in accordance with 20-21-12.

(5) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Install the overflow pipe (Ref. para.2.).

R (2) Carry out a Leakage Test and a Functional Test
R (Ref. Adjustment/Test).

4. Overflow Relief Valve Motor

A. Equipment and Materials

	DESCRIPTION	PART NO.
R	Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(2) Trip the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, and fit a safety clip.

(3) Open the access panel 153 DB.

C. Remove Valve Motor

NOTE: The valve motor is mounted on studs and secured by locknuts. A dowel pin ensures correct orientation.

(1) Disconnect the electrical connector from the valve.

(2) Remove the four locknuts securing the motor to the valve body.

(3) Remove the motor by carefully disengaging the splines

of the output shaft and valve spindle.

(4) Note the position of the motor as displayed in the aperture at the base of the motor.

D. Install Valve Motor

(1) Comply with the fuel and electrical safety precautions.

(2) Check that the splines of the output shaft and the mating surfaces of the motor and valve are clean and undamaged.

(3) Ensure that the position of the valve motor coincides with the position of the valve, as noted during removal.

NOTE: The mechanical indicator at 'O' signifies that the motor is in the valve-open position; the indicator at 'S' signifies that the motor is in the valve-shut position.

(4) Align the master splines of the motor output shaft and valve spindle and assemble the motor to the valve body, ensuring that the dowel pin is correctly orientated.

(5) Fit the self-locking nuts to the studs. Torque-tighten the nuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(6) Connect the electrical connector to the motor, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the overflow relief valve circuit breaker previously tripped.

(2) Remove the warning placard from the fuel management panel.

(3) Fit the access panel 153 DB.

(4) Carry out an Operational Test of the valve (Ref. Adjustment/Test).

OVERFLOW RELIEF VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The overflow relief valve is mounted in the rear fuselage immediately aft of the scavenge tank.

There are three control modes; fuel level sensors in the scavenge tank, a tank overpressure switch and a tank underpressure switch control the normal operation of the overflow relief valve. An ORV TEST switch is provided on the refuel control panel, 1-194.

The following procedures use only the test switch and level sensors. The pressure switches are checked after individual removal/installation or at system level in 28-12-00.

R The topic comprises an Operational Test, a Functional Test
R that includes leakage tests, and a separate Leakage Test of
R the valve in the closed position. A System Test is not applicable in this instance.

2. Operational Test

A. Prepare

(1) Ensure that the fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Open the refuel control access panel, 194 JB.

(3) With electrical ground power off, check that the ORV TEST magnetic indicator displays diagonal stripes.

B. Test

(1) Make available electrical ground power as detailed in 24-41-00.

NOTE: The scavenge tank pump will run for approximately 30 s when electrical power is first switched on.

(2) Check that the ORV magnetic indicator displays SHUT.

(3) Operate and hold the ORV TEST switch at "TEST". Check that -

(a) the valve motor is heard to operate, and

(b) the magnetic indicator display changes from SHUT to diagonal stripes then to OPEN, within 3 s.

(4) Release the ORV TEST switch. Check that -

(a) the valve motor is heard to operate, and

(b) the magnetic indicator display changes from OPEN to diagonal stripes then to SHUT, within 3 s.

C. Conclusion

(1) Set the refuel master switch to "OFF/DEFUEL".

(2) Close the refuel control access panel, 194 JB.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Receptacle, for fuel, 50 gal (227 l)	-
Adapter, fuel overflow pipe	E925127000
Hose, 3 in ID	-
Bonding cable	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Check, by reference to the fuel quantity indicators (FQIs), that there is sufficient fuel in tank 2, i.e., at least 1000 kg, and spare capacity in tank 3 to receive up to 500 kg of fuel during these tests. If necessary, refuel (Ref. 12-11-28) or defuel the aircraft (Ref. 28-25-00, Servicing).

(4) Fit the fuel overflow pipe adapter, complete with bung, to the ORV overflow outlet.

(5) Position a clean 50 gal (227 l) receptacle beneath the ORV overflow outlet. Electrically bond the receptacle to the aircraft.

(6) Open the refuel control panel access door, 194 JB.

(7) Remove access panel 153 EB in the rear fuselage.

(8) Inhibit the operation of the scavenge pump by tripping the circuit breakers.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6

C. Test

(1) Transfer 150 kg of fuel to the scavenge tank and vent pipes as follows:-

(a) On panel 2-214 (3CM), set the TRIM PIPE DRAIN switch to "OPEN". Check that the indicators display OPEN.

(b) Set the tank 2 JETTISON switch to "OPEN".

(c) Set a tank 2 standby ENGINE FEED PUMP (Ref. 28-21-00) switch to "ON". Check that the associated LOW PRESS caption is extinguished.

(2) When the fuel has transferred, set -

(a) the TRIM PIPE DRAIN switch to "SHUT",

(b) the standby ENGINE FEED PUMP switch to "OFF" and

(c) the tank 2 JETTISON switch to "SHUT".

(3) Check that the ORV mechanical indicator displays O and the magnetic indicator displays OPEN.

(4) Retain the ORV open by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15.

(5) Check that there is no leakage of fuel from the ORV and its associated pipe connections over a minimum period of 10 min.

CAUTION: THE ORV CIRCUIT BREAKER MUST NOT BE RESET WITHIN 45 s OF BEING TRIPPED IN OPERATION (4), AS THE TIME DELAY CIRCUIT IN THE LEVEL-PACK WILL NOT HAVE DECAYED AND THE ORV WILL NOT CLOSE WHEN THE CIRCUIT BREAKER IS RESET.

(6) Reset the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, for 5 s, then trip the circuit breaker and secure it with a safety clip.

NOTE: The ORV will close as the time delay circuit in the level-pack will prevent the sensors from signalling the valve open.

(7) Check that the overflow relief valve mechanical indicator displays S and the magnetic indicator displays diagonal stripes.

(8) Drain residual fuel from the pipe downstream of the ORV via the drain plug in the adapter bung.

(9) Remove the adapter from the ORV outlet and remove the bung from the adapter.

(10) Fit the hose to the adapter and refit the adapter to the ORV outlet. Position the hose in the

receptacle.

(11) Reset the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15. Check that the ORV opens after a time delay of 30(±2) s.

(12) When the ORV opens check that the fuel in the scavenge tank empties at a rate not less than 20 gal (72 kg) in 30 s.

NOTE: When the fuel level in the scavenge tank drops below the level of the ORV sensors, the ORV will close after a time delay of 30(±2) s.

(13) Check that the overflow relief valve mechanical indicator displays S.

(14) Reset the scavenge pump circuit breakers which were tripped before the test. Allow the scavenge pump to empty the tank.

(15) Set the TRIM PIPE DRAIN switch to "OPEN". Check that the indicators display OPEN.

(16) Set the JETTISON MASTER VALVES switches to "OPEN". Check that the indicators display bar-in-line.

(17) When the scavenge pump indicator, on panel 2-214, displays OFF, set the TRIM PIPE DRAIN switch to "SHUT" and check that the indicators display SHUT.

(18) Set the JETTISON MASTER VALVES switches to "SHUT" and check that the indicators display bar-across-line, then set the switches to "OFF".

D. Conclusion

(1) Remove the drain adapter and hose.

(2) Disconnect the electrical bonding and remove the receptacle.

(3) Close the refuel control access panel, 194 JB.

(4) Refit access panel 153 EB in the rear fuselage.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 4. Leakage Test - Valve Closed

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Receptacle for fuel, 50 gal (Imp.) (227 l)	-
Bonding cable	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Check, by reference to the fuel quantity indicators (FQIs), that there is sufficient fuel in tank 3, i.e., at least 1,000 kg. If necessary, refuel (Ref. 12-11-28), or defuel (Ref. 28-25-00, Servicing) or transfer fuel (Ref. 28-00-00, Servicing).

(4) Inhibit the operation of the scavenge pump by tripping the circuit breakers.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6

(5) Position a clean 50 gal (Imp.) (227 l) receptacle beneath the ORV overflow outlet. Electrically bond the receptacle to the aircraft.

(6) Ensure that the refuel control panel access door, 194 JB, is closed.

NOTE: With the door closed, the circuit is in the 'flight' condition and, therefore, the scavenge tank ORV sensors are inhibited from signalling the ORV open.

(7) Remove access panel 153 EB in the rear fuselage.

(8) Check that the ORV mechanical indicator is at S.

C. Test

(1) Transfer 100 kg of fuel to the scavenge tank and vent pipes as follows:-

(a) On panel 2-214 (3CM), set the TRIM PIPE DRAIN switch to "OPEN". Check that the indicators display OPEN.

(b) Set the tank 3 JETTISON switch to "OPEN".

(c) Set a tank 3 standby ENGINE FEED PUMP (Ref. 28-21-00) switch to "ON". Check that the associated LOW PRESS caption is extinguished.

(2) When the fuel has transferred, leave the TRIM PIPE DRAIN switch at OPEN and set -

(a) the standby ENGINE FEED PUMP switch to "OFF", and

(b) the tank 3 JETTISON switch to "SHUT".

(3) At the ORV outlet, check over a period of 15 min that the leak does not exceed 10 drops per minute.

(4) Reset the scavenge pump circuit breakers which were tripped before the test. Allow the scavenge pump to empty the tank.

D. Conclusion

(1) Set the TRIM PIPE DRAIN switch to "SHUT"; ensure that the indicators display SHUT.

(2) Disconnect the electrical bonding and remove the receptacle.

(3) Refit access panel 153 EB in the rear fuselage.

(4) Switch off and disconnect electrical ground power

R as detailed in 24-41-00.

SCAVENGE TANK SENSORS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Three identical sensors are mounted on the outside wall of the scavenge tank. The removal/installation procedure is the same in each case. The lower sensor, mounted on a flange next to the scavenge pump, senses the presence of fuel in the tank and automatically controls the operation of the scavenge pump. The two upper sensors, mounted on the LH and RH sides of the scavenge tank, provide an automatic control of the overflow relief valve (ORV). Access to the sensors is gained through an access panel in the bottom of the rear fuselage.

The following procedures include a test that enables the time delays on the sensor operations to be checked accurately with the sensors removed from the scavenge tank. The complete installation is tested in the Adjustment/Test procedure, but this does not allow accurate checking of the time delays.

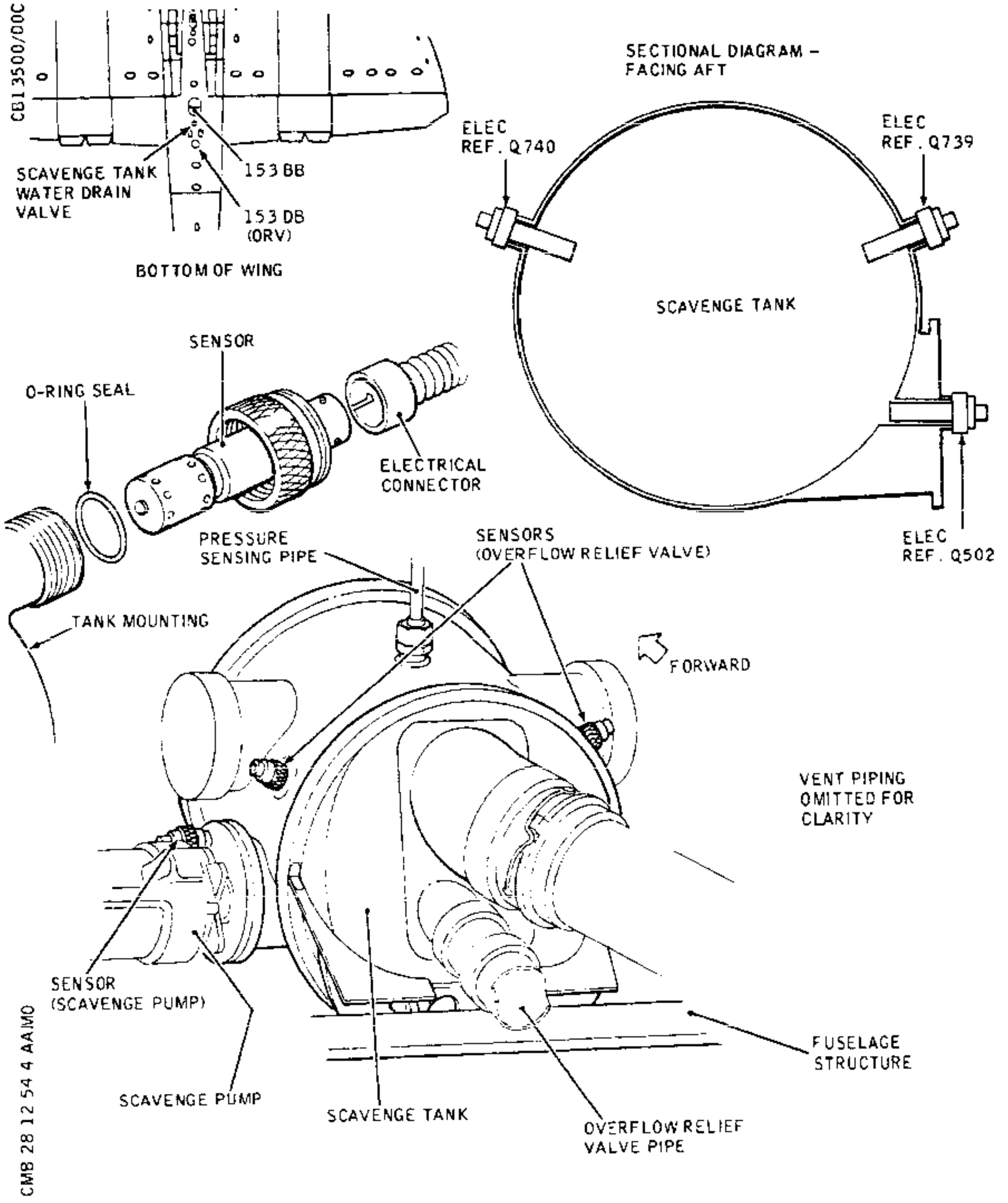
2. Sensor (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
R Drain tool	D92-5373000
Container	-

B. Prepare to Remove

(1) Ensure that the management panel switches are at their usual ground settings (Ref. 28-00-00, Servicing). Place placards on the fuel management and refuelling panels warning that the position of the switches must not be changed.



R – Scavenge Tank Sensors - Installation
Figure 401

(2) Using the drain tool, drain residual fuel (approx. 1 gal (4.5 l)) from the scavenge tank.

(3) Electrically isolate the scavenge pump or overflow relief valve, as appropriate, by tripping its associated circuit breaker(s); fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15

(4) Remove the access panel 153 BB on the bottom surface of the rear fuselage in order to gain
R access to the scavenge tank. Also remove access
R panel 153 DB if required, in order to gain access
R to the ORV.

C. Remove

(1) Disconnect the electrical connector from the sensor; cover and stow the connector.

(2) Unscrew the sensor by hand from its mounting.

(3) Remove and discard the O-ring seal.

(4) Fit a suitable blank to the aperture in the scavenge tank.

D. Prepare to Install

NOTE: The ORV sensors and the scavenge pump sensor must be tested before installation.

(1) Carry out either of the following procedures (2) or (3), as appropriate.

(2) ORV Sensor Test

(a) Connect the electrical connector to the

sensor.

R (b) Check that the refuel control panel access door is open and ensure that the refuel master switch is at OFF/DEFUEL.

R (c) Make available electrical ground power as detailed in 24-41-00.

R (d) To ensure that the sensor element is 'cool', check that the overflow relief valve supply circuit breaker is still tripped (Ref. para.2.B.(3)).

R (e) Fill a small container with at least 1 in (25 mm) depth of clean fuel.

R (f) Immerse the sensor in the fuel in the small container.

R (g) Reset the overflow relief valve supply circuit breaker; check that the ORV opens after a time delay of 35 to 45 s and the mechanical indicator on the ORV is at O.

R (h) Remove the sensor from the fuel; check that the ORV closes after a time delay of 30 to 34 s and the mechanical indicator on the ORV is at S.

R (i) Again immerse the sensor in the fuel; check that the ORV opens within 2 s. Remove the sensor from the fuel.

R (j) Trip the overflow relief valve supply circuit breaker and fit a safety clip.

(3) Scavenge Pump Sensor Test

(a) Connect the electrical connector to the sensor.

(b) Reset the scavenge pump circuit breakers which were tripped before removal.

(c) Make available electrical ground power as detailed in 24-41-00.

NOTE: When electrical power is first switched on the scavenge pump will run for 30(±2) s due to the 'warming up' of the sensor.

(d) Fill a small container with at least 1 in (25 mm) depth of clean fuel.

(e) After the 'warming up' period, immerse the sensor in the fuel; check that the scavenge pump operates.

(f) Remove the sensor from the fuel; check that
R pump operation ceases after a time delay of
R 30 to 34 s.

(4) Trip the appropriate circuit breakers (Ref. para.2.B.(3)).

(5) Remove the electrical connector from the sensor.

(6) Fit the sensor with a new O-ring seal lubricated with fuel.

E. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blank from the aperture in the scavenge tank.

(3) Insert the sensor into its mounting and hand-tighten it.

(4) Connect the electrical connector to the sensor, ensuring that the mating surfaces are clean and undamaged. Check that the electrical identification reference number on the cable sleeve is the same as that next to the sensor mounting.

F. Conclusion

(1) Remove the safety clips and reset the circuit breaker(s) tripped before removal of the sensor.

(2) Carry out a Functional Test, followed by a Leakage Test (Ref. Adjustment/Test).

(3) Refit the access panel(s).

(4) Remove the placards from the fuel management and refuelling panels.

R (5) Close the refuel control panel access door.

R (6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

SCAVENGE TANK SENSORS - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises a Functional Test of the scavenge pump sensor, a Functional Test of the overflow relief valve (ORV) sensors, and a Leakage Test.

Controls and indicators required for the tests are on the fuel management panel (third crew member's station) and on the refuel control panel.

Access to the sensors is gained by removing a panel on the bottom surface at the rear fuselage.

Operational and System Tests are not required in this application.

2. Scavenge Pump Sensor Functional Test

A. Equipment and Materials

NOTE: The following equipment may not be required. Refer to paragraph C.(2).

DESCRIPTION	PART NO.
Receptacle, 50 gal (227 l), for fuel spillage	-
Bonding lead, for receptacle	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings and that all refuelling valve switches are set to SHUT (Ref. 28-00-00, Servicing).

(2) Remove the access panel 153 BB on the bottom surface of the rear fuselage.

(3) If required (Ref. para.C.(2)), position a clean 50 gal (227 l) receptacle, electrically bonded to the aircraft, beneath the jettison pipe outlets.

(4) Ensure that electrical power is switched off.

C. Test

(1) Make available electrical ground power, as detailed in 24-41-00, and check that the scavenge pump runs immediately when electrical power is switched on. On the fuel management panel, check that the scavenge pump indicator displays ON for 30(±2) s. This is due to the warming-up characteristics of the sensor. Check that the pump then stops and the indicator displays OFF.

(2) Allow fuel to flow under gravity into the scavenge tank as follows:-

(a) Set the TRIM PIPE DRAIN valves switch to "OPEN" and check that both the associated magnetic indicators display OPEN.

(b) Admit air into the trim pipe, either -

b1) by setting the JETTISON MASTER VALVES switches to "OPEN", or

b2) by setting both tank 9 trim INLET VALVE switches to "OPEN" if tank 9 is empty.

(c) Set the appropriate switches accordingly, checking that their associated magnetic indicators display bar-in-line.

NOTE: If the jettison master valves are opened, fuel spillage overboard from the jettison pipes may result.

(3) As soon as the scavenge pump indicator displays ON, set the TRIM PIPE DRAIN valves switch to "SHUT" immediately; check that the associated magnetic indicators display SHUT.

(4) Check that the scavenge pump magnetic indicator displays OFF approximately 30 s after first displaying ON.

NOTE: The scavenge pump continues to run for

30(±2) s after the sensor is uncovered by the fuel.

(5) Set all fuel management panel switches to their normal ground settings (Ref. 28-00-00, Servicing).

D. Conclusion

(1) Refit the access panel 153 BB.

(2) If applicable, disconnect the electrical bonding and remove the receptacle.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. ORV Sensors Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Receptacle, 50 gal (227 l), for fuel overflow	-
Bonding lead, for receptacle	-
R Fuel overflow pipe adapter	E925127030
Flexible hose, 3 in (76.2 mm) ID, 12 ft (3.66 m) long, for fuel overflow	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Fit a fuel overflow pipe adapter to the ORV overflow outlet.

(4) Attach a 3 in (76.2 mm) flexible hose to the

adapter.

(5) Position a clean 50 gal (227 l) receptacle to receive fuel overflow via the hose. Electrically bond the receptacle to the aircraft.

(6) Open the refuel control panel access door 194 JB.

(7) On the refuel control panel, check that the ORV magnetic indicator displays SHUT.

(8) Remove the access panel 153 BB in the rear fuselage.

(9) Inhibit the scavenge pump and the ORV by tripping the following circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15

C. Test

NOTE: Each sensor must be tested independently. This necessitates the electrical disconnection of the sensor not under test.

(1) Disconnect the electrical connector from the sensor not under test.

(2) At the fuel management panel, transfer approximately 150 kg of fuel from tank 3 into the scavenge tank and vent pipes, using the following procedure.

NOTE: The quantity of fuel transferred is determined by noting a decrease of 150 kg in the tank 3 fuel quantity indicator reading.

(a) Set the TRIM PIPE DRAIN valves switch to "OPEN" and check that both the associated magnetic indicators display OPEN.

(b) Set tank 3 jettison valve switch to "OPEN" and check that the associated magnetic indicator displays bar-in-line.

(c) Set tank 3 1st standby ENGINE FEED PUMP switch to "ON"; check that the LOW PRESS caption is extinguished as pump pressure builds up.

(d) On completion of the transfer, proceed as follows:-

d1) Set tank 3 ENGINE FEED PUMP switch to "OFF".

d2) Set the TRIM PIPE DRAIN valves switch to "SHUT" and check that both the associated magnetic indicators display SHUT.

d3) Set tank 3 jettison valve switch to "SHUT" and check that the associated magnetic indicator displays bar-across-line.

(3) Remove the safety clip and reset the ORV circuit breaker.

(4) Check that the ORV opens after 35 to 45 s, by observing that a minimum of 20 gal (91 l) of fuel flows out of the ORV outlet during a period of approximately 30 s before the ORV closes.

NOTE: The ORV closes within 30 to 34 s of the sensor becoming uncovered by the fuel.

(5) On the refuel control panel, check that the ORV magnetic indicator displays SHUT.

(6) Connect the electrical connector to the other sensor, ensuring that the mating surfaces are clean and undamaged.

(7) Empty the receptacle.

(8) Repeat the above test for the second sensor (Ref. paras.(1) to (6)).

(9) Reset the scavenge pump circuit breakers which were tripped before the test. Allow the scavenge pump to empty the tank.

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D. Conclusion

(1) Disconnect the electrical bonding and remove the receptacle.

R (2) Remove the fuel overflow pipe adapter and hose.

R (3) Close the refuel panel access door 194 JB.

R (4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R (5) Refit the access panel 153 BB in the rear fusealge.

4. <u>Leakage Test</u>

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

R (2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (3) Open the refuel control panel access door 194 JB.

R (4) On the refuel control panel, check that the ORV magnetic indicator displays SHUT.

R (5) Remove the access panel 153 BB in the rear fuselage.

R (6) Inhibit the scavenge pump and the ORV by tripping the following circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	F1
SCAVENGE PUMP CONT & IND	15-216	Q493	C6
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15

B. Test

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(1) At the fuel management panel, transfer approximately 75 kg of fuel from tank 3 into the scavenge tank, using the following procedure.

NOTE: The quantity of fuel transferred is determined by noting a decrease of 75 kg in the tank 3 fuel quantity indicator reading.

(a) Set the TRIM PIPE DRAIN valves switch to "OPEN" and check that both the associated magnetic indicators display OPEN.

(b) Set tank 3 jettison valve switch to "OPEN" and check that the associated magnetic indicator displays bar-in-line.

(c) Set tank 3 1st standby ENGINE FEED PUMP switch to "ON"; check that the LOW PRESS caption is extinguished as pump pressure builds up.

(d) On completion of the transfer, proceed as follows:-

d1) Set tank 3 ENGINE FEED PUMP switch to "OFF".

d2) Set the TRIM PIPE DRAIN valves switch to "SHUT" and check that both the associated magnetic indicators display SHUT.

d3) Set tank 3 jettison valve switch to "SHUT" and check that the associated magnetic indicator displays bar-across-line.

B (2) Check that there is no external leakage from the
B Scavenge tank, Sensors, Connecting Pipes or ORV
B over a period of 10 mins.

(3) Remove the safety clips and reset the scavenge pump circuit breakers which were tripped before the test. Check that the pump indicator displays ON and that the pump runs.

(4) Allow the pump to empty the tank. Check that the pump stops and that the indicator displays OFF.

C. Conclusion

(1) Remove the safety clip and set the ORV circuit breaker which was tripped before the test.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Refit the access panel 153 BB in the rear fuselage.

(4) Close the refuel control panel access door 194 JB.

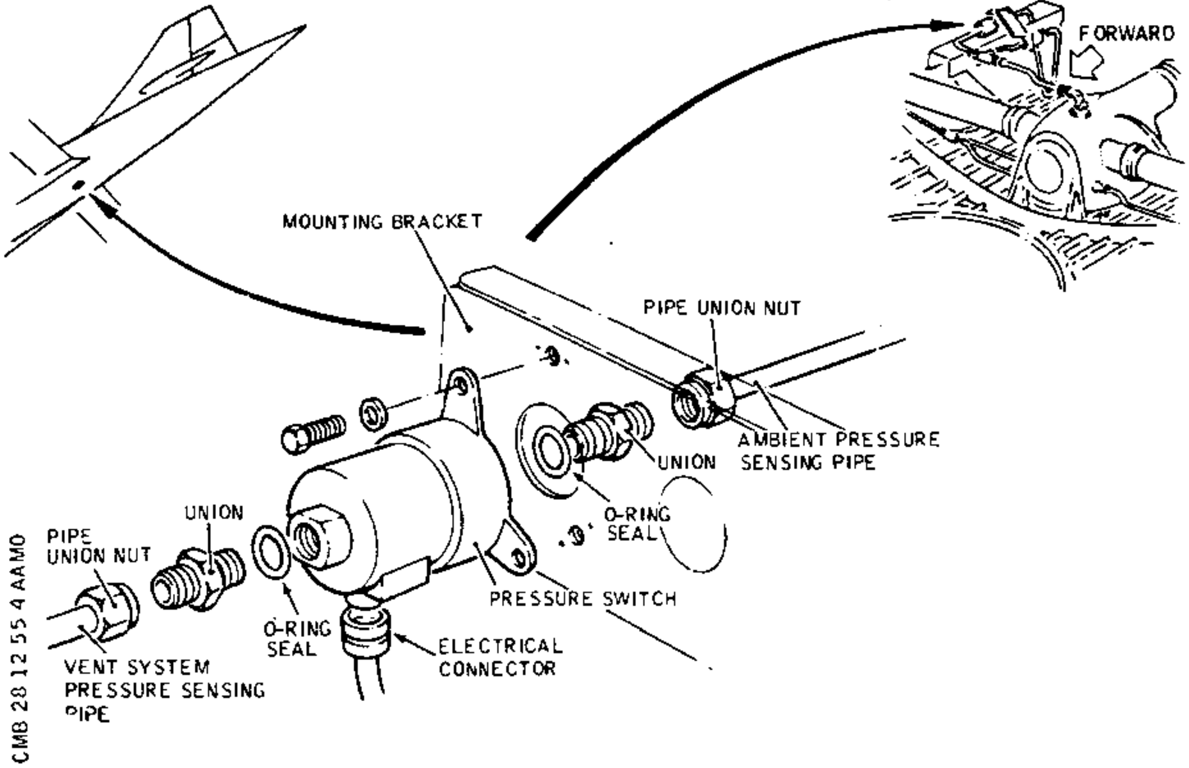
VENT UNDERPRESSURE PRESSURE SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

The vent underpressure pressure switch is mounted on a bracket in the rear fuselage underfloor equipment bay.



- Vent Underpressure Pressure Switch - Installation
Figure 401

2. Vent Underpressure Switch

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

Torque spanner, 40 to 45 lbf in (0.45 to 0.51 mdaN) -

Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN) -

B. Prepare

(1) Electrically isolate the pressure switch by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721 on panel 1-213, map ref.K15, and fit a safety clip.

(2) Gain access to the pressure switch by removing panels 153 BB and 153 DB in the fuselage bottom skin.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the pressure sensing pipes from the pressure switch.

(3) Remove the bolts and washers securing the pressure switch to the mounting bracket and remove the pressure switch.

(4) Remove the unions from the pressure switch and discard the O-ring seals.

(5) Fit suitable blanks to the pressure switch ports and the open pipe ends.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the pressure switch ports and the pipes.

(3) Lightly lubricate new O-ring seals with system fuel and fit an O-ring seal and union at each port of the pressure switch in accordance with 20-23-11; torque-tighten each union to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(4) Position the pressure switch on the forward face

of the mounting bracket and secure it with the washers and bolts; torque-tighten the bolts to between 40 and 45 lbf in (0.45 and 0.51 mdaN) in accordance with 20-21-11.

(5) Check that the pressure switch is electrically bonded in accordance with 20-27-11.

(6) Connect the pressure sensing pipes to the unions in accordance with 20-23-11 and torque-tighten the pipe union nuts to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(7) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breaker tripped before removal.

(2) Perform a Functional Test of the pressure switch (Ref. Adjustment/Test).

(3) Refit the access panels removed to gain access to the switch.

VENT UNDERPRESSURE PRESSURE SWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

The vent underpressure pressure switch is connected to the vent system scavenge tank. It is located on a bracket in the rear fuselage underfloor equipment bay. When the fuel tank pressure is 1.5 psi (0.103 bar) lower than the ambient pressure, the pressure switch operates to open the vent overflow relief valve.

This topic comprises a Functional Test. Operational and System Tests are not considered necessary in this application.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a pressure of 10 psig (0.689 bar)	-
Plug adapter, fuel vent ambient sense pipe in tank 11	E925054

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Remove access panels 153 BB and 153 DB in the fuselage bottom skin.

(4) Using a plug adapter, blank off the ambient sense line intake on one side of tank 11.

(5) Fit a plug adapter to the ambient sense line intake on the opposite side of tank 11 and connect to it the air supply rig.

C. Test

(1) Perform the following test of the switch function:-

(a) Slowly apply a pressure to the sense line and check that the underpressure pressure switch operates to open the vent overflow relief valve when the pressure is between 1.5 and 1.6 psig (0.103 and 0.110 bar).

(b) Slowly release the pressure and check that the vent overflow relief valve closes with the decrease in pressure (0.70 psig (0.048 bar) min.).

(2) Perform the following leakage test:-

(a) Ensure that the ambient sense line drain valve is closed.

(b) Apply a pressure of 3 psig (0.207 bar) to the ambient sense line for a period of 5 min and check the pressure switch-to-pipe connection for freedom from leaks.

(c) Release the pressure in the ambient sense line and remove the air supply rig and plug adapter from the vent ambient sense line intake at one side of tank 11.

(d) Remove the plug adapter, blanking the vent ambient sense line, at the opposite side of tank 11.

(e) Perform a fluid leak test of the pressure switch (Q728) connection to the pressure sense line as detailed for single pipe replacement (Ref. 28-12-00, Adjustment/Test, Pipes in Dry Bays).

D. Conclusion

(1) Refit the access panels 153 BB and 153 DB in the fuselage bottom skin.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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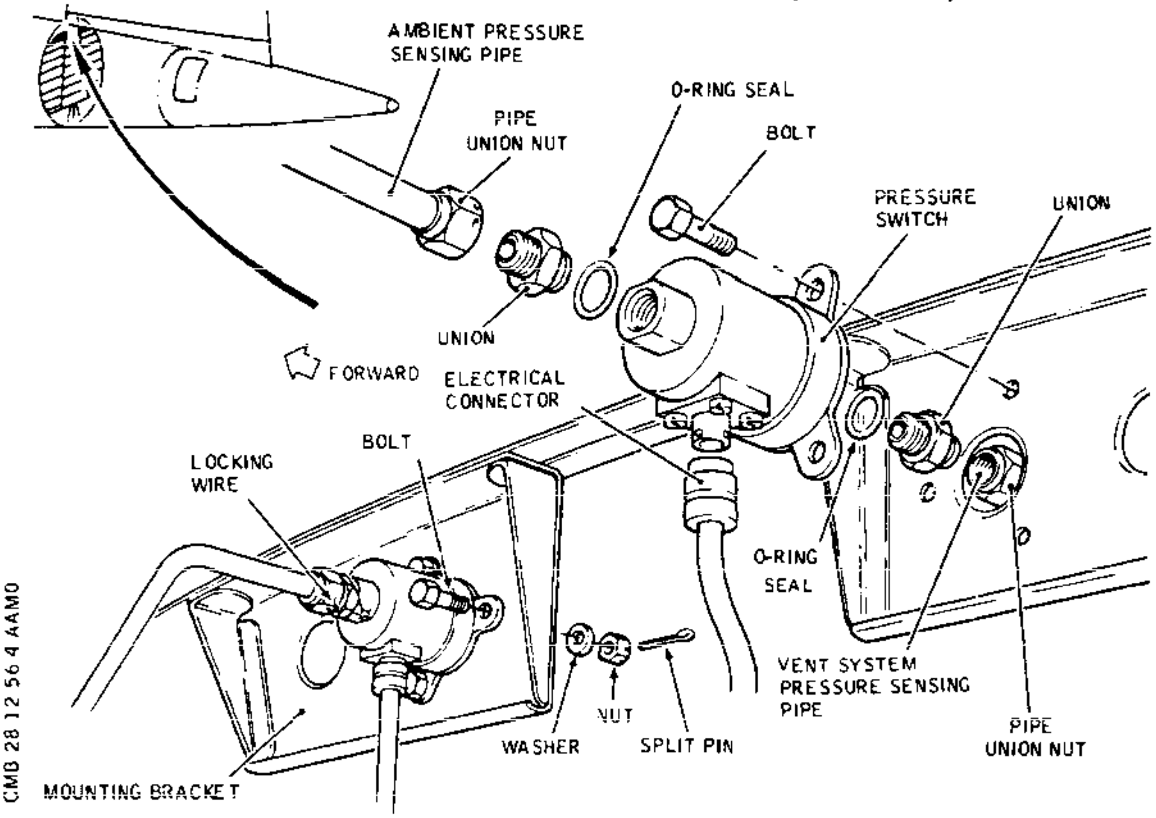
VENT OVERPRESSURE PRESSURE SWITCH (SHUT-OFF VALVE) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

Two vent overpressure pressure switches are fitted at the top of fuselage frame 89 in the tailcone. They are located on left-hand and right-hand brackets respectively.



Vent Overpressure Pressure Switch - Installation
Figure 401

2. Vent Overpressure Pressure Switch

A. Equipment and Materials

DESCRIPTION	PART NO.

Circuit breaker safety clip -

Torque spanner, 40 to 50 lbf in (0.45 to 0.51 mdaN) -

Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN) -

B. Prepare

(1) Electrically isolate the pressure switch by tripping the appropriate circuit breaker.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH VENT VALVE SUP	1-213	Q722	K16
RH VENT VALVE SUP	3-213	Q723	D7

(2) Gain access to the pressure switches from the tail wheel bay.

CAUTION: OBSERVE THE SAFETY PRECAUTIONS DETAILED IN 32-71-00.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Remove the locking wire from the pipe union nuts at the pressure switch and disconnect the pipes from the unions.

(3) Remove the split pin, nuts and washers from the bolts securing the pressure switch to the mounting bracket and remove the bolts and pressure switch.

(4) Remove the unions from the pressure switch and discard the O-ring seals.

(5) Fit suitable blanks to the pressure switch ports and pipe ends.

D. Install

(1) Comply with the fuel, electrical and landing gear safety precautions.

(2) Remove the blanks from the pressure switch ports and pipe ends.

(3) Lightly lubricate new O-ring seals with system fuel and fit the O-ring seals and unions to the pressure switch in accordance with 20-23-11; torque-tighten the unions to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(4) Position the pressure switch on the forward face of the mounting bracket and secure it in position with the bolts, washers and nuts; torque-tighten the nuts to between 40 and 45 lbf in (0.45 and 0.51 mdaN) in accordance with 20-21-11.

(5) Check that the pressure switch is electrically bonded in accordance with 20-27-11.

(6) Lock the nuts with split pins in accordance with 20-21-12.

(7) Connect the pipes to the unions at the pressure switch in accordance with 20-23-11 and torque-tighten the union nuts to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(8) Wire-lock the pipe union nuts to the pressure switch with 0.036 in (0.91 mm) dia. locking wire (DTD 189) in accordance with 20-21-13.

(9) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breaker tripped before removal.

(2) Perform a Functional Test of the pressure switch (Ref. Adjustment/Test).

VENT OVERPRESSURE PRESSURE SWITCH (SHUT-OFF VALVE) - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE LANDING GEAR SAFETY PRECAUTIONS DETAILED IN 32-71-00.

1. General

Two vent overpressure pressure switches are connected into the vent pipes in the tail cone immediately forward of the vent shut-off valves. When the differential between the pressure in the vent system and ambient pressure is 3.75 psi (0.258 bar), the switches operate to open the vent shut-off valves.

This topic contains a Functional Test. Operational and System Tests are not considered necessary in this application.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing suction and pressure between -15 and +10 psig (-1.034 and +0.690 bar)	-
Plug adapter	E92.5054

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

C. Test

(1) Perform the following test of the switch function:-

(a) Connect the air supply rig to the sense line

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of the associated absolute pressure switch (Ref. 28-12-57, Adjustment/Test) and slowly apply a suction of between 2.05 and 2.65 psia (0.141 and 0.183 bar) and check that the switch operates to close its associated vent shut-off valve. Check that the visual indicator on the valve shows SHUT.

(b) Using a plug adapter, blank off the ambient sense line intake on one side of tank 11.

(c) Fit a plug adapter to the ambient sense line intake on the opposite side of tank 11 and connect to it the air supply rig.

(d) Slowly apply a suction to the ambient sense line and check that the vent overpressure pressure switch operates to open the associated vent shut-off valve when the pressure is between -3.55 and -3.75(-0.245 and -0.258 bar).

(e) Slowly release the suction and check that the vent shut-off valve closes at -2.75 psig (-0.189 bar) pressure.

(f) Release the suction on the absolute pressure switch sense line and check that the associated vent shut-off valve opens.

(g) Disconnect the air supply rig from the absolute pressure switch and reconnect the sense lines (Ref. 28-12-57, Removal/Installation).

(2) Perform the following leakage test:-

(a) Apply a pressure of 3 psig (0.207 bar) to the ambient sense line intake at tank 11 for a period of 5 min and check for freedom from leaks at the pipe connections.

D. Conclusion

(1) Release the pressure on the ambient sense line and disconnect the air supply rig and remove the plug adapter from the ambient sense line intake.

(2) Remove the plug adapter from the ambient sense pipe line intake on the opposite side of tank 11.

(3) Switch off and disconnect electrical ground power

as detailed in 24-41-00.

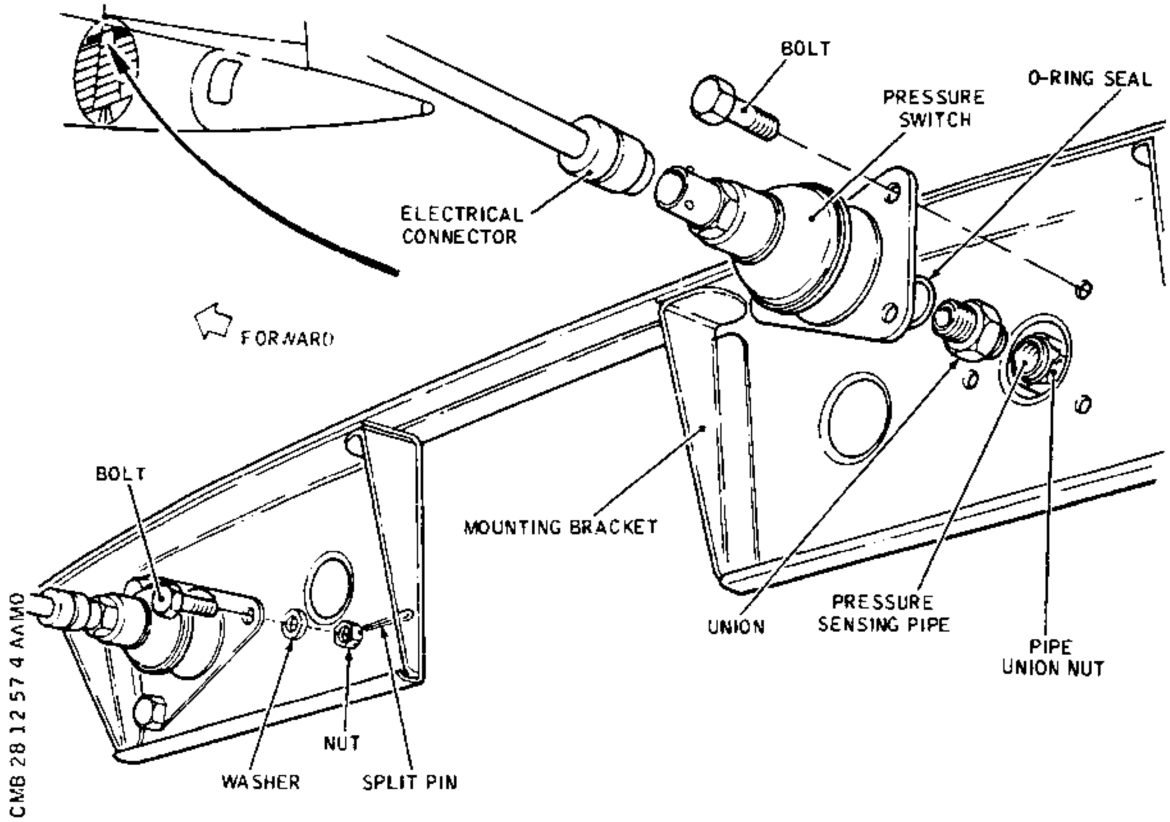
VENT ABSOLUTE PRESSURE SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

Two vent absolute pressure switches are fitted at the top of fuselage frame 89 in the tail cone. They are located on left-hand and right-hand brackets respectively.



- Vent Absolute Pressure Switch - Installation
Figure 401

2. Vent Absolute Pressure Switch

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

Torque spanner, 40 to 45 lbf in (0.45 to 0.51 mdaN) -

Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN) -

B. Prepare

(1) Electrically isolate the pressure switch by tripping the appropriate circuit breaker.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH VENT VALVE SUP	1-213	Q722	K16
RH VENT VALVE SUP	3-213	Q723	D7

(2) Gain access to the pressure switch from the tail wheel bay.

CAUTION: OBSERVE THE SAFETY PRECAUTIONS DETAILED IN 32-71-00.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Remove the locking wire from the pipe union nut at the pressure switch and disconnect the pipe from the union.

(3) Remove the split pins, nuts and washers from the bolts securing the pressure switch to the mounting bracket and remove the bolts and pressure switch.

(4) Remove the union from the pressure switch and discard the O-ring seal.

(5) Fit a suitable blank to the pressure switch port and pipe end.

D. Install

(1) Comply with the fuel, electrical and landing gear safety precautions.

(2) Remove the blank from the pressure switch port and pipe end.

(3) Lightly lubricate a new O-ring seal with system fuel and fit the O-ring seal and union to the pressure switch in accordance with 20-23-11; torque-tighten the union to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-23-12.

(4) Position the pressure switch on the forward face of the mounting bracket and secure it with the bolts, washers and nuts; torque-tighten the nuts to between 40 and 45 lbf in (0.45 and 0.51 mdaN) in accordance with 20-21-11.

(5) Check that the pressure switch is electrically bonded in accordance with 20-27-11.

(6) Lock the nuts with split pins in accordance with 20-21-12.

(7) Connect the pipe union nut to the union at the pressure switch in accordance with 20-23-11 and torque-tighten the union nut to between 40 and 65 lbf in (0.45 and 0.73 mdaN) in accordance with 20-21-12.

(8) Wire-lock the pipe union nut to the pressure switch with 0.36 in (0.91 mm) dia. locking wire (DTD 189) in accordance with 20-21-13.

(9) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breaker tripped before removal.

(2) Perform a Functional Test of the pressure switch (Ref. Adjustment/Test).

VENT ABSOLUTE PRESSURE SWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE LANDING GEAR SAFETY PRECAUTIONS DETAILED IN 32-71-00.

1. General

Two vent absolute pressure switches are connected into the vent pipes in the tail cone immediately aft of the vent shut-off valves. At an altitude of approximately 44,000 feet, the switches operate to close the vent shut-off valves. This topic contains a Functional Test. Operational and System Tests are not considered necessary in this application.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a suction of -15 psig (-1.034 bar)	-

B. Prepare

(1) Check that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

C. Test

(1) Connect the air supply rig to the pipe connector on the absolute pressure switch.

(2) Slowly apply suction to the sense line and check that the switch operates to close its associated vent shut-off valve when the pressure is between 2.05 and 2.65 psia (0.141 and 0.183 bar). Check that the visual indicator on the valve shows SHUT.

(3) Slowly release the suction on the sense line and check that the vent shut-off valve opens with the increase in pressure. Check that the visual indicator on the valve shows OPEN.

D. Conclusion

(1) Release the suction on the sense line and disconnect the air supply rig from the absolute pressure switch sense line.

(2) Reconnect the sense line to the absolute pressure switch (Ref. Removal/Installation).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

TRIM PIPE DRAIN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The two trim pipe drain valves are bolted to mounting plates in the rear fuselage. The motor end of each valve is secured by a clip to a block on the mounting plate. Provision is made for the motor and gearbox unit to be removed without disturbing the valve or fuel connections. A panel in the rear fuselage provides access to the valves. The procedures detailed include the removal of a failed-shut drain valve.

2. Trim Pipe Drain Valve (Ref. Fig. 401)

A. Equipment and Materials

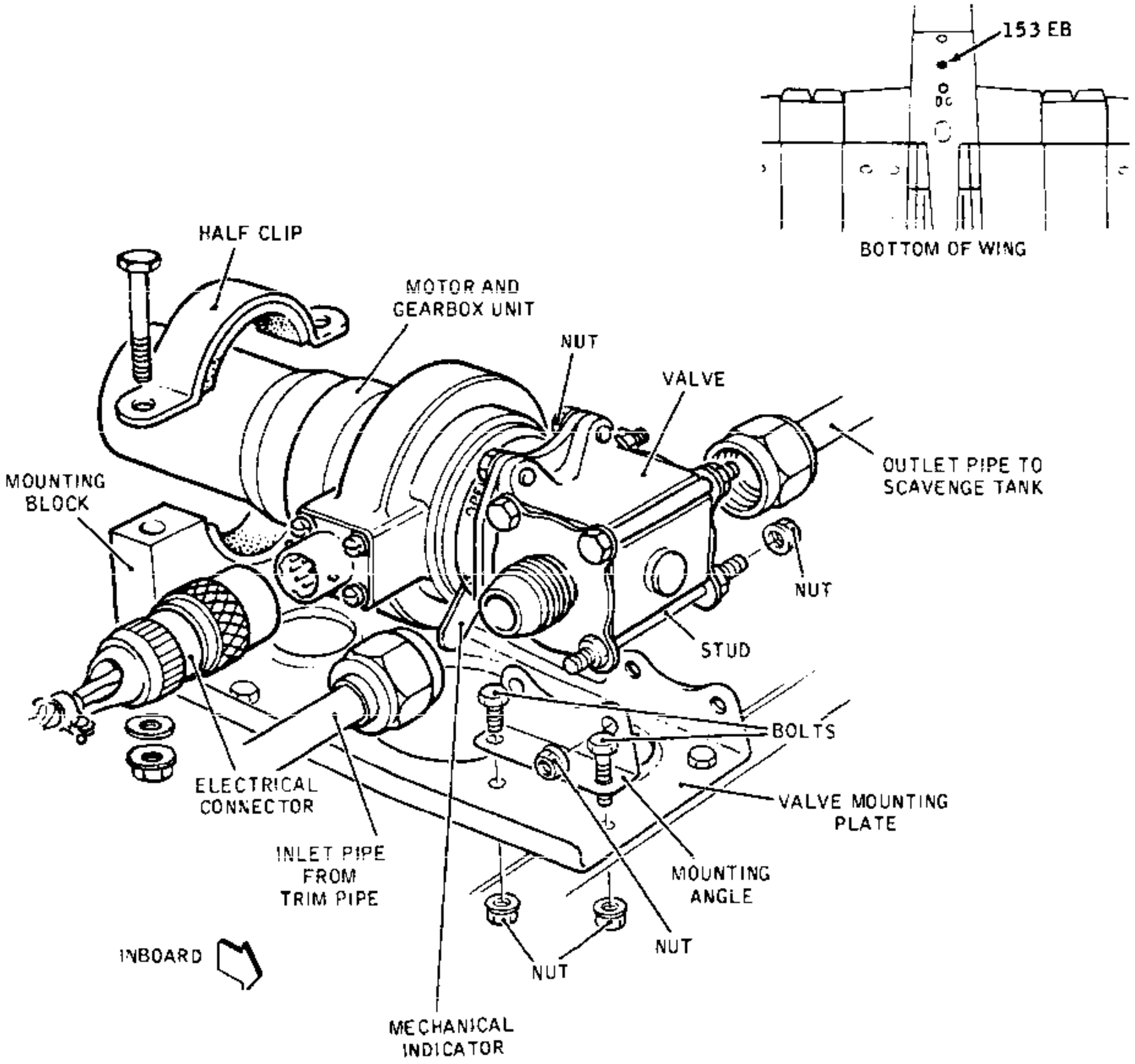
DESCRIPTION	PART NO.
Torque spanner, 27 to 31 lbf in (0.305 to 0.350 mdaN)	-
Torque spanner, 30 to 40 lbf in (0.339 to 0.452 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Suitable fuel receptacle	-
Circuit breaker safety clips	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Position a suitable fuel receptacle under the jettison outlets in the rear tail cone.

(3) Make available electrical ground power as detailed



Trim Pipe Drain Valve
Figure 401

R in 24-41-00.

R (4) If the valve has not failed shut, proceed as follows:-

R (a) Drain the trim transfer pipe of fuel. At the fuel management panel:

R a1) Set the JETTISON MASTER VALVES switches to "OPEN". Check that the associated magnetic indicator display changes to bar-in-line.

R a2) Set the TRIM PIPE DRAIN switch to "OPEN" and check that both LH and RH magnetic indicators display OPEN.

R a3) If the scavenge pump indicator displays ON, wait until the indicator displays OFF again, then set the TRIM PIPE DRAIN switch to "SHUT" and check that both LH and RH magnetic indicators display SHUT.

R a4) Disregard operation (5) and proceed with operations (6), (7) and (8).

R (5) If the drain valve has failed shut, proceed as follows:-

R (a) Remove the drain valve motor and gearbox (Ref. para.3.).

R <u>CAUTION</u>: DO NOT USE EXCESSIVE FORCE WHEN MANUALLY OPENING THE VALVE, AS DEBRIS CREATED BY EXCESSIVE FORCE DAMAGING THE VALVE AND SEALS WILL ENTER THE SCAVENGE TANK.

R (b) Using a suitable tool, grip the drive shaft of the valve and attempt to manually open the valve.

R (c) If the valve opens, proceed as follows:-

R c1) Set the JETTISON MASTER VALVES switches to "OPEN". Check that the associated magnetic indicator display changes to bar-in-line.

R c2) If the scavenge pump indicator displays ON wait until the scavenge pump indicator again displays OFF.

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c3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

c4) Disregard operations (6), (7) and (8) and proceed with the removal as detailed in paragraph C.

(d) If the valve remains shut, proceed as follows:-

d1) Partially drain the trim transfer pipe by defuelling collector tank 2 or 3, as appropriate (Ref. 28-25-00).

d2) With the appropriate collector tank defuelled, set the associated tank 2 or 3 STANDBY INLET VALVES switches to "OPEN".

d3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

CAUTION: RESIDUAL FUEL WILL BE IN THE DRAIN PIPES ATTACHED TO THE DRAIN VALVE. TAKE APPROPRIATE ACTION TO ABSORB AND CLEAN UP SPILLED FUEL.

d4) With a suitable blank to hand, disconnect the inlet pipe to the drain valve and immediately blank off the pipe union.

d5) Disregard operations (6), (7) and (8) and proceed with the removal as detailed in paragraph C.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(7) Trip the TRIM PIPE DRAIN VALVES SUP & IND circuit breaker Q707 on panel 15-215, map ref.G22, and fit a safety clip.

(8) Remove the access panel (Ref. Fig. 401).

C. Remove Trim Pipe Drain Valve

(1) Disconnect the electrical connector from the valve.

(2) Disconnect the inlet and outlet pipes from the valve. Fit suitable blanks to the pipe union nuts.

(3) Remove the nuts securing the valve to the valve

R mounting plate and mounting angle.

R (4) Remove the nuts, washers and bolts securing the
R half clip to the mounting block.

R (5) Remove the bolts and nuts securing the mounting
R angle to the valve mounting plate. Remove the
R mounting angle.

R (6) Remove the valve, complete with motor and gearbox
R unit. Fit suitable blanks to the valve pipe
R connectors.

R D. Install Trim Pipe Drain Valve

R (1) Comply with the fuel and electrical safety
R precautions.

R (2) Position the valve, complete with motor and gearbox
R unit, on the mounting plate.

R (3) Fit the mounting angle to the valve studs. Fit
R the longer bolt, of the two mounting angle securing
R bolts, to the inboard hole then fit the other bolt.
R Secure the angle to the mounting plate with the
R bolts and nuts. Torque-tighten the nuts to between
R 30 and 40 lbf in (0.339 to 0.452 mdaN).

R (4) Loosely fit the four nuts to the valve studs.

R (5) At the motor end of the valve, position the half
R clip and secure it to the mounting block with bolts,
R washers and nuts. Do not torque-tighten the nuts
R at this stage.

R (6) Remove the blanks from the valve pipe connectors
R and the pipes. Check that the mating surfaces of
R the valve pipe connectors and the pipe union nuts
R are clean and undamaged, then connect the inlet and
R outlet pipes to the valve. Torque-tighten each union
R nut to between 150 and 250 lbf in (1.695 and 2.825
R mdaN).

R (7) Torque-tighten each nut securing the valve and half
R clip to the mounting to between 27 and 31 lbf in
R (0.305 and 0.350 mdaN), and the nuts securing the
R valve to the mounting bracket to between 30 and 40
R lbf in (0.339 and 0.452 mdaN).

R (8) Ensuring that the mating surfaces are clean and
R undamaged, connect the electrical connector to the

valve.

R (9) Check the bonding of the installation (Ref. 20-27-11).

E. Conclusion

(1) Remove the safety clip and reset the trim pipe drain valve circuit breaker previously tripped.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Reset the JETTISON MASTER VALVES switches to "SHUT". Check that the associated magnetic indicator display changes to bar-across-line. Then set the switches to "OFF" and close the guard cover.

(4) If the tank 2 or 3 STANDBY INLET VALVES are open, set the associated switch to "SHUT".

(5) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

(6) Refit the access panel (Ref. Fig. 401), and remove the fuel receptacle.

3. Motor and Gearbox Unit (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque spanner, 27 to 31 lbf in (0.305 to 0.350 mdaN)	-
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare

(1) Ensure that all fuel managment panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Trip the TRIM PIPE DRAIN VALVES SUP & IND circuit breaker Q707 on panel 15-215, map ref.G22, and fit

a safety clip.

(3) Remove the access panel (Ref. Fig. 401).

C. Remove Motor and Gearbox Unit

(1) Disconnect the electrical connector from the motor.

(2) Remove the nuts and washers securing the half clip. Remove the half clip.

(3) Remove the nuts securing the motor and gearbox to the valve.

(4) Remove the motor and gearbox.

D. Install Motor and Gearbox Unit

(1) Comply with the fuel and electrical safety precautions.

(2) With the valve closed, ensure that the mechanical indicator on the motor and gearbox is at SHUT. If the valve is open ensure that the motor and gearbox mechanical indicator is at OPEN.

(3) Ensure that the dowel hole in the motor and gearbox flange is aligned with the dowel in the valve body, and assemble the motor and gearbox unit to the valve body with the nuts. Torque-tighten the nuts to betweem 28 and 32 lbf in (0.316 and 0.362 mdaN).

(4) Fit the half clip over the motor and to the mounting block with the bolts, washers and nuts. Torque-tighten the nuts to between 27 and 31 lbf in (0.305 and 0.350 mdaN).

(5) Ensuring that the mating surfaces are clean and undamaged, connect the electrical connector to the valve motor.

R (6) Check the bonding of the installation (Ref. 20-27-11).

E. Conclusion

(1) Reset the circuit breaker previously tripped.

(2) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

(3) Refit the access panel (Ref. Fig. 401).

TRIM PIPE DRAIN VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

   The two trim pipe drain valves are flange mounted on brackets in the rear fuselage. The two valves are controlled by a single switch on the fuel mangement panel, and when open, the valves enable the trim pipes to be drained into the the scavenge tank. The switch has two positions, OPEN and SHUT, and is normally set to SHUT.

2. Function Test (Ref. Fig. 501)

   A. Prepare to Test

      (1) Ensure that all fuel mangement panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

      (2) Ensure that the refuel control panel access door, 194 KB is closed.

      (3) Make available electrical ground power (Ref. 24-41-00).

      (4) Remove access panels 153 CB and 153 DB.

      (5) Obtain communication between the flight compartment and the testing area (Ref. 23-41-00).

   B. Test

      (1) On the fuel management panel, set tank 9 PUMPS switches to ON and then set the TRIM PIPE DRAIN switch to "OPEN" and check that:

         (a) The valves open within two seconds of operating the switch.

         (b) The LH and RH magnetic indicators show OPEN.

         (c) The visual indicator on each valve shows OPEN.

         (d) Check that the scavenge pump indicator shows ON.

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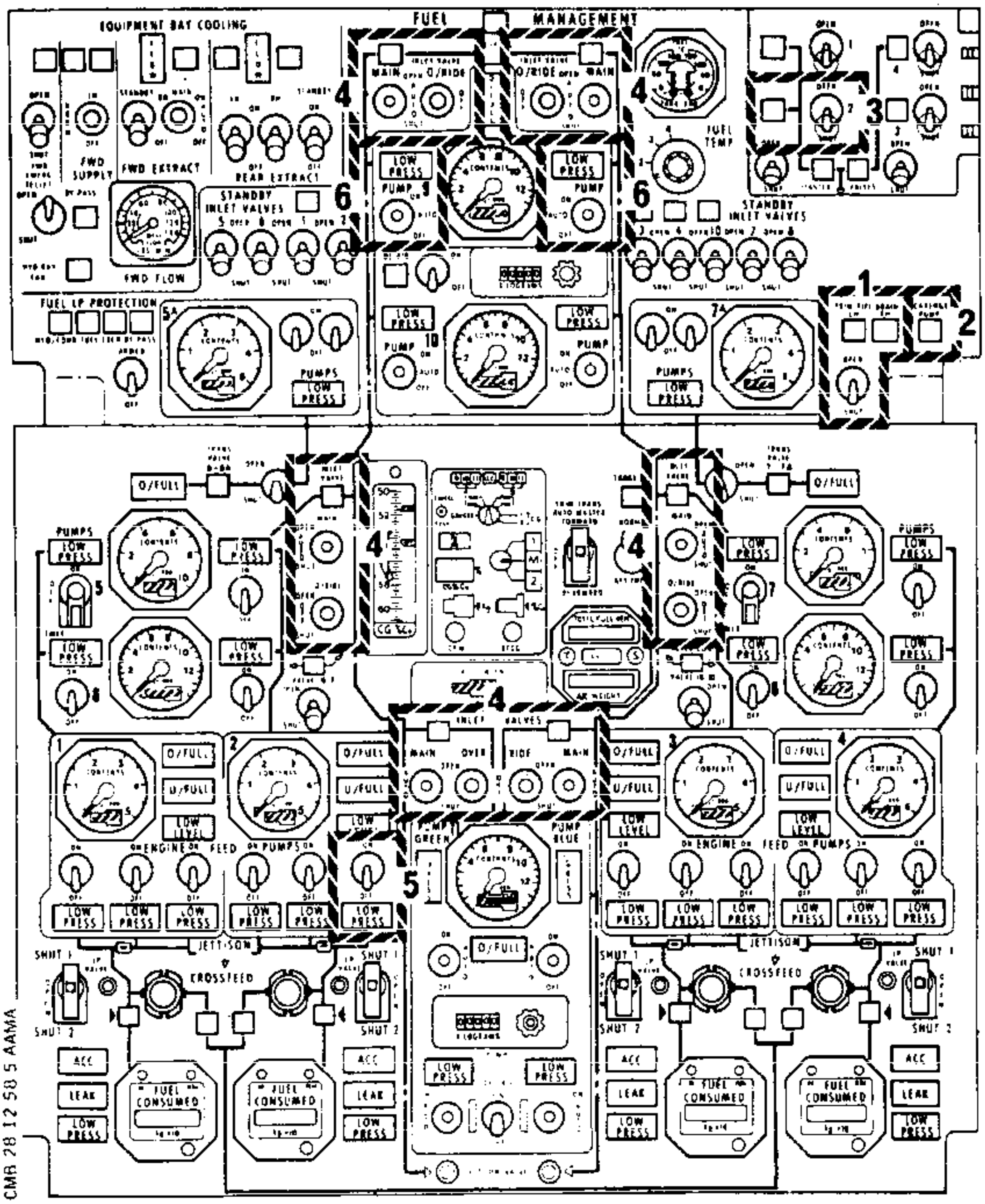
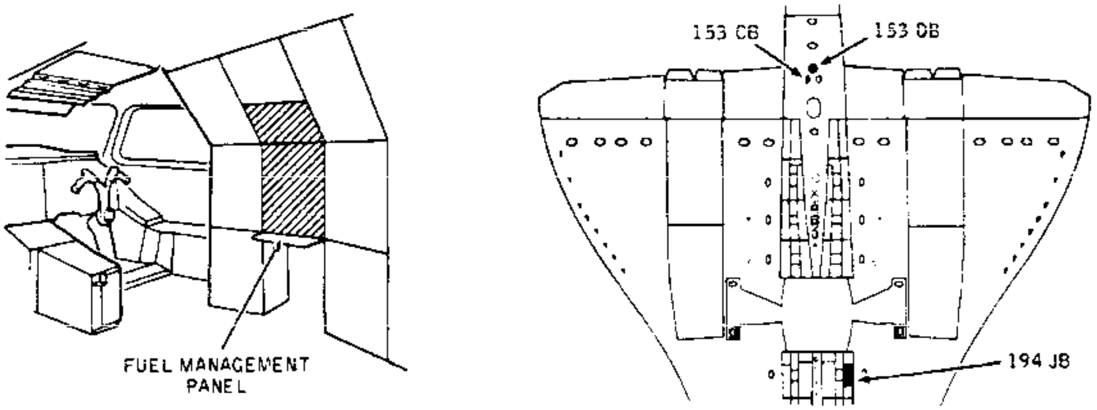


- Trim Pipe Drain Valve - Test Controls and Location (Sheet 1 of 2)
Figure 501



1 TRIM PIPE DRAIN VALVE CONTROL SWITCH AND INDICATORS
2 SCAVENGE PUMP INDICATOR
3 No.2 COLLECTOR TANK JETTISON VALVE CONTROL SWITCH AND INDICATOR
4 TANK INLET VALVE CONTROL SWITCHES AND INDICATORS
5 No.2 COLLECTOR TANK 2nd STANDBY ENGINE FEED PUMP CONTROL SWITCH AND CAPTION LIGHT
6 TANK 9 PUMP SWITCHES AND CAPTION LIGHTS

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- Trim Pipe Drain Valve - Test Controls and Location (Sheet 2 of 2)
Figure 501

(2) Set the tank 9 PUMPS switches to OFF then set the TRIM PIPE DRAIN switch to "SHUT" and check that:

(a) The valve shuts within two seconds of operating the switch.

(b) The LH and RH magnetic indicators show SHUT.

(c) The visual indicator on each valve shows SHUT.

(d) The scavenge pump indicator shows OFF within 30 seconds of setting the trim pipe drain switch to SHUT.

3. Leak Test (Ref. Fig. 501)

A. Prepare to Test

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Ensure that the refuel control panel access door, 194 KB, is closed.

(3) Make available electrical ground power (Ref. 24-41-00).

(4) Remove access panels 153 CB and 153 DB.

(5) Obtain communication between the flight compartment and the testing area (Ref. 23-41-00).

B. Test

(1) On the fuel management panel, set the TRIM PIPE DRAIN switch to "OPEN" and check at the valves for any external leakage of fuel from the valve and pipe connections.

(2) On the fuel management panel:

(a) Set the TRIM PIPE DRAIN switch to "SHUT" and check that the LH and RH magnetic indicators show SHUT.

(b) Set the switch for the No. 2 collector tank jettison valve to "OPEN" and check that the associated magnetic indicator gives an in-line indication.

(c) Check that all tank inlet valve switches are set to SHUT and their associated magnetic indicators give a cross-line indication.

(d) Set the switch for No.2 collector tank 2nd standby engine feed pump to "ON", to pressurize the trim transfer pipe, and check that the associated caption light illuminates and then extinguishes indicating correct build-up of pump pressure.

(3) Check for any external leakage of fuel from the valve and pipe connections.

C. Conclusion

(1) On the fuel management panel:

(a) Set the switch for No.2 collector tank 2nd standby engine feed pump to "OFF" and check that the associated caption light illuminates and then extinguishes, indicating correct run-down of pump pressure.

(b) Set the switch for the No.2 collector tank jettison valve to "SHUT" and check that the associated magnetic indicator gives a cross-line indication.

(2) Switch off and disconnect the communication set (Ref.23-41-00).

(3) Refit the access panels 153 CB and 153 DB.

(4) Switch off and disconnect electrical ground power (Ref. 24-41-00).

SCAVENGE PUMP - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

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1. General

This topic contains the procedures for the removal and installation of a scavenge pump and its mounting plate.

The scavenge pump is located on the left-hand side of the scavenge tank. Access to the tank is gained by removal of panels in the bottom of the rear fuselage.

The pump, electrically controlled by a level sensor fitted in the pump mounting plate, transfers fuel from the scavenge tank to No.3 collector tank.

The scavenge tank must be drained before removal of the pump.

2. Scavenge Pump (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Fuel drain tool	D925374000
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Viton sealant, PT 1720SM (Ref. 20-30-00, No.351)	-
Cleaning solvent, BAC.M 302 (Ref. 20-30-00, No.473)	-
Container for collecting fuel (40 gal (Imp.) (182 l) max.)	-
Locking wire	-

B. Prepare to Remove Pump

(1) Ensure that the management panel switches are at their usual ground settings (Ref. 28-00-00, Servicing). Place placards on the fuel management and refuelling panels warning that the position of the switches must not be changed.

(2) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q 491	E 4
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

(3) Remove the access panels 153 AB and 153 BB.

(4) Position the container beneath the water drain valve. Electrically bond the container to the aircraft.

(5) Using the fuel drain tool, release the fuel from the scavenge tank. When fuel stops flowing, remove the tool.

(6) Position a suitable container below the pump drain plug. Remove the plug and allow the residual fuel to drain from the delivery pipe. When fuel stops flowing, refit the plug. If the pump is to be reinstalled, torque-tighten the plug to between 23 and 25 lbf in (0.260 and 0.282 mdaN). Wire-lock the plug in accordance with 20-21-13.

C. Remove Pump

(1) Disconnect the electrical connector from the pump.

NOTE: The screw-thread of the electrical connector is locked with sealant. Considerable force will be needed to unscrew the connector.

(2) Support the pump and remove the four bolts (1) and washers.

(3) Carefully withdraw the pump from the mounting plate. Remove the breather piston.

(4) Remove, and discard, the O-ring seals from the pump spigots and breather piston.

(5) Fit suitable blanks to the ports of the mounting plate and pump, and to the breather piston.

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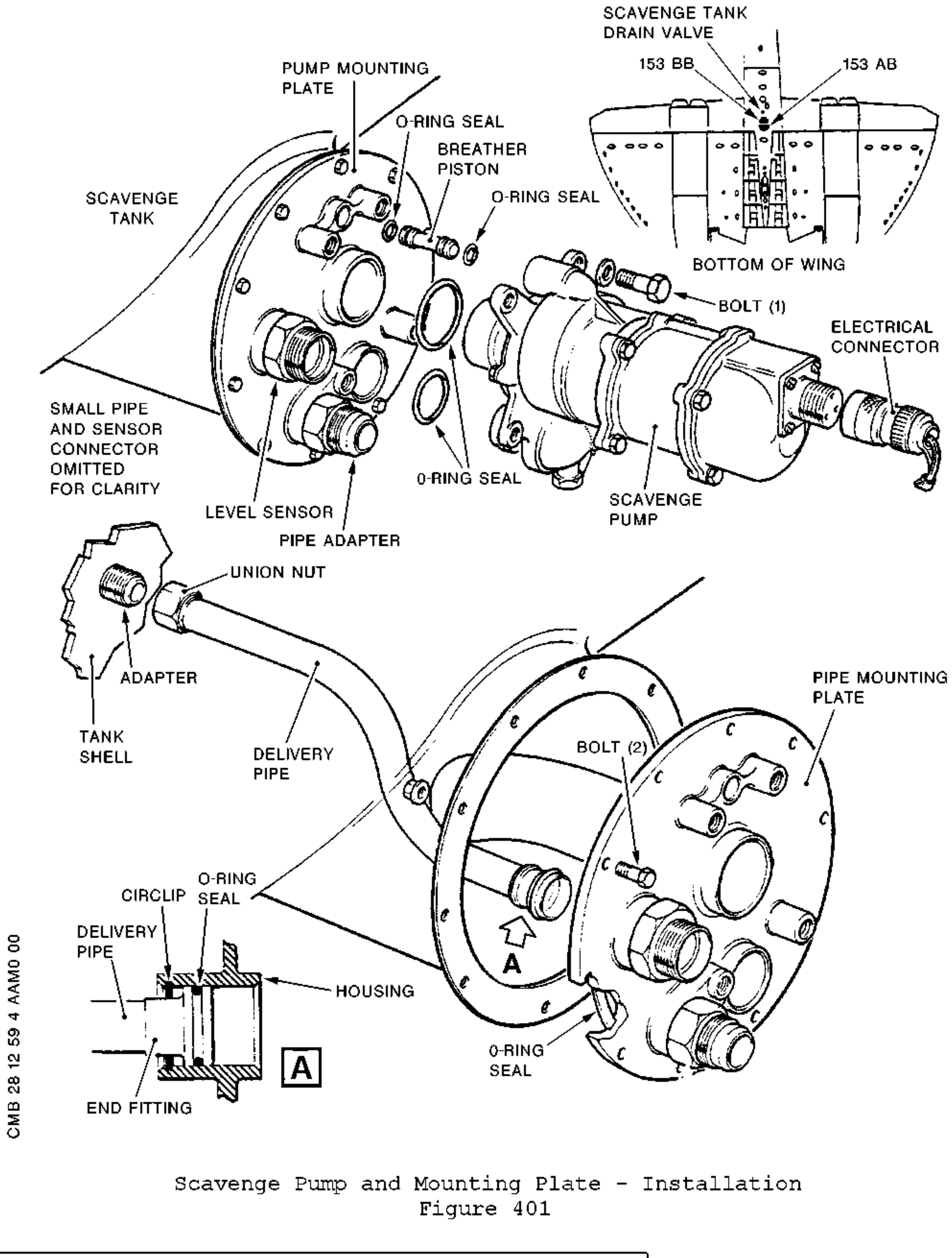

Scavenge Pump and Mounting Plate - Installation
Figure 401

D. Prepare to Install Pump

(1) Remove the blanks from the ports of the pump, and from the breather piston.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the spigots of the pump and to the breather piston.

(3) Carefully insert the breather piston into the pump body, ensuring that the O-ring seal is not damaged.

E. Install Pump

(1) Comply with the electrical safety precautions.

(2) Remove the blanks from the ports of the mounting plate.

(3) Position the pump and carefully ease the pump spigots and breather piston into the mounting plate ports, ensuring that the O-ring seals are not damaged.

(4) Fit the four bolts (1) and washers. Tighten the bolts in a diametrical sequence, and finally torque-tighten them to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(5) Using the cleaning solvent and Viton sealant in accordance with the Wiring Diagram Manual, 20-42-48, connect the electrical connector to the pump.

(6) Check that the electrical bonding between the pump and mounting plate is in accordance with 20-27-11.

(7) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(2)).

F. Conclusion

(1) Carry out a Leakage Test and an Operational Test as detailed in Adjustment/Test.

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3. Mounting Plate (Ref. Fig.401)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 15 to 20 lbf in (0.169 to 0.226 mdaN)	-
Torque spanner, 31 to 40 lbf in (0.350 to 0.452 mdaN)	-
Torque spanner, 200 to 350 lbf in (2.260 to 3.955 mdaN)	-
Locking wire	-

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B. Prepare to Remove Mounting Plate

(1) Remove the pump (Ref. para.2.).

(2) Remove the tank access cover, located on the forward end of the scavenge tank.

C. Remove Mounting Plate

(1) Remove the level sensor (electrical ref. №.0502) as detailed in 28-12-54.

(2) Disconnect the pipe from the adapter on the mounting plate and immediately fit a suitable blank to the pipe.

CAUTION: IMMEDIATELY AFTER OPERATION (3), ENSURE THAT ALL LOCKING WIRE AND TOOLS ARE REMOVED FROM THE INTERIOR OF THE SCAVENGE TANK.

(3) Working through the access hole in the scavenge tank, remove the locking wire and fully unscrew the union nut of the delivery pipe.

(4) Temporarily fit the tank access cover.

(5) Remove the nuts and bolts (2) securing the mounting plate.

(6) Carefully withdraw the mounting plate with the two pipes attached, ensuring that the pipes are not damaged. Remove and discard the O-ring seal from the mounting plate.

(7) If required, remove the delivery pipe from the mounting plate (Ref. Detail A), as follows:

(a) Compress the circlip and move it back along the delivery pipes.

(b) Move the delivery pipe through the housing in the mounting plate, so that the end fitting emerges from the housing at the end opposite the circlip groove. Remove and discard the O-ring seal.

(c) Remove the pipe from the mounting plate. Fit suitable blanks to the pipe.

D. Install Mounting Plate

(1) If applicable, install the delivery pipe in the mounting plate, as follows:

(a) Remove the blanks from the delivery pipe.

(b) Insert the delivery pipe through the mounting plate housing, until the end fitting emerges from the end opposite the circlip groove.

<u>CAUTION</u>: IN OPERATIONS (c), (d) AND (e), AFTER A NEW O-RING SEAL HAS BEEN FITTED ENSURE THAT THE SEAL DOES NOT PASS THE CIRCLIP GROOVE, OR THE SEAL MAY BE DAMAGED.

(c) Fit a new O-ring seal, previously lubricated in accordance with 20-23-11, to the groove in the end fitting.

(d) Carefully pull the end fitting into the housing, until the smaller diameter of the fitting just emerges through the housing.

(e) Compress the circlip and insert it in the housing, ensuring that the circlip engages in its groove.

(f) Check that the circlip eye-ends are clear of the end fitting by 0.005 in (0.127 mm), minimum.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the mounting plate.

(3) Place the pipes of the mounting plate in the scavenge tank and position the plate.

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(4) Fit the bolts (2) and nuts. Tighten the nuts in a diametrical sequence, and finally torque-tighten them to between 31 and 40 lbf in (0.350 and 0.452 mdaN).

(5) Remove the tank access cover.

CAUTION: IMMEDIATELY AFTER OPERATION (6), ENSURE THAT ALL LOCKING WIRE AND TOOLS ARE REMOVED FROM THE INTERIOR OF THE SCAVENGE TANK.

(6) Working through the access hole in the tank, align the delivery pipe with the adapter. Fit and tighten the union nut. Lock the nut to the locking tab with wire in accordance with 20-21-13.

(7) Check that all tools, locking wire and any foreign matter are removed from the scavenge tank interior.

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R (8) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (9) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the access cover.

R (10) Position the access cover on the tank and fit the bolts and washers. Tighten the bolts in a diametrical sequence, and finally torque-tighten them to between 15 and 20 lbf in (0.169 and 0.226 mdaN).

R (11) Install the level sensor as detailed in 28-12-54.

R (12) Connect the pipe to the adapter on the mounting plate in accordance with 20-23-12. Torque-tighten the union nut to between 200 and 350 lbf in (2.260 and 3.955 mdaN).

R (13) Check that the electrical bonding between the mounting plate and scavenge tanks is in accordance with 20-27-11.

E. Conclusion

(1) Install the pump (Ref. para.2.).

SCAVENGE PUMP - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The scavenge pump is mounted on the scavenge tank in the rear fuselage. The pump is controlled by a level sensor (Ref. 28-12-54, Adjustment/Test) in the scavenge tank. When the tank fuel content rises above 3 gal (13.64 l), the pump operates and transfers fuel to tank 3. When the fuel content falls below the level sensor, the pump continues to run for 30 s and empties the tank to the level of the pump inlet. At this stage, 1 gal (4.55 l) remains in the tank.

This topic comprises an Operational Test and a Leakage Test of the pump. Functional and System Tests are not applicable.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure, by reference to the fuel quantity indicators, that tanks 2 and 3 are approximately 90 per cent full. Transfer fuel (Ref. 28-00-00, Servicing) if necessary.

(4) Switch off electrical ground power.

(5) Open the access panel 153 BB on the bottom surface of the rear fuselage.

B. Test

(1) Make available electrical ground power, as detailed in 24-41-00, checking that the scavenge pump is heard to run immediately electrical power is switched on.

(2) On the fuel management panel, check that the scavenge pump magnetic indicator displays ON for 30(±2) s.

This is due to the warming-up characteristics of the sensor. Check that the pump then stops and the indicator displays OFF.

(3) Set the tank 2 STANDBY INLET VALVE switch to "OPEN"; check that the associated magnetic indicator displays bar-in-line.

(4) Set the TRIM PIPE DRAIN switch to "OPEN" and check that both LH and RH valve magnetic indicators display OPEN. Leave the switch in this position for 4 min.

(5) Check that the scavenge pump magnetic indicator displays ON during operation (4) and that fuel is being transferred from tank 2 to tank 3.

(6) After 4 min have elapsed, set the TRIM PIPE DRAIN switch to "SHUT" and check that the LH and RH magnetic indicators display SHUT.

(7) Allow a further 30(±2) s to elapse and check that the scavenge pump magnetic indicator displays OFF.

(8) Check, by reference to the fuel quantity indicators of tanks 2 and 3, that at least 127 kg have been transferred to tank 3.

C. Conclusion

(1) Set tank 2 STANDBY INLET VALVE switch to "SHUT"; check that the associated magnetic indicator displays bar-across-line.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Close the access panel 153 BB.

3. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure, by reference to the fuel quantity indicators, that tanks 2 and 3 are approximately 90 per cent full. Transfer fuel (Ref. 28-00-00, Servicing) if necessary.

(4) Open the access panel 153 BB on the bottom surface of the rear fuselage.

(5) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q491	E4
SCAVENGE PUMP CONT & IND	15-216	Q493	C6
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q721	K15

C. Test

(1) Set the tank 2 STANDBY INLET VALVE switch to "OPEN" and check that the associated magnetic indicator displays bar-in-line.

(2) Note the reading on tank 2 fuel quantity indicator.

(3) Set the TRIM PIPE DRAIN switch to "OPEN" and check that both LH and RH valve magnetic indicators display OPEN.

(4) When tank 2 fuel quantity indicator reading is 50 kg less than that noted in operation (2), set the TRIM PIPE DRAIN switch to "SHUT" and check that both LH and RH valve magnetic indicators display SHUT.

(5) Check that there is no external leakage of fuel from the scavenge tank over a period of 10 min.

R (6) Reset the scavenge pump circuit breakers tripped in
R operation B.(5) and allow the scavenge pump to empty
R the tank; check that there is no fuel leakage from
R the pump or its tank mounting while the pump is
R running.

R (7) When the scavenge pump magnetic indicator displays
R OFF, reset the overflow relief valve circuit breaker
R tripped in operation B.(5).

D. Conclusion

R (1) Set the tank 2 STANDBY INLET VALVE switch to "SHUT";
R check that the associated magnetic indicator displays
R bar-across-line.

R (2) Close the access panel 153 BB.

R (3) Switch off and disconnect electrical ground power
R as detailed in 24-41-00.

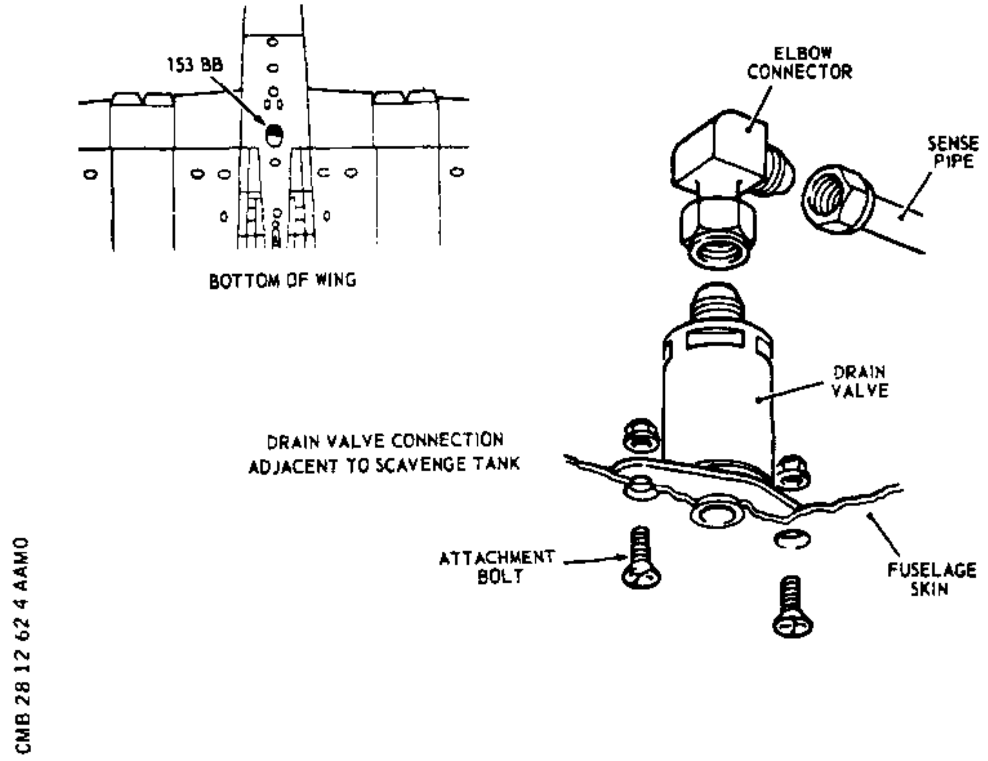
AMBIENT SENSE LINE DRAIN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS IN 28-00-00.

1. General

The ambient sense line drain valve is bolted to the lower fuselage skin between frames 74 and 75. Access to the valve is through fuselage access panel 153 BB.

2. Ambient Sense Line Drain Valve (Ref. Fig. 401)



- Ambient Sense Line Drain Valve - Installation
Figure 401

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque screwdriver (30 to 125 lbf in;0.396 to 1.413 mdaN range)	-

B. Removal

(1) Remove access panel 153 BB.
(2) Place a container under the valve to catch any fuel which may be in the ambient sense pipe.

(3) Unscrew the union to disconnect the valve from the ambient sense pipe. Fit a blank cover over the pipe end.

(4) Remove the bolts securing the valve to the fuselage skin and remove the valve. Fit a blank cover over the valve aperture.

C. Installation.

(l) Remove the blank cover from the valve aperture and position the valve on the fuselage skin.

(2) Fit the two bolts and self-locking nuts to secure the valve to the fuselage skin. Torque load the bolts to a minimum of 35-40f lb in (0.396 to 0.452 mdaN).

(3) Remove the blank cover from the sense pipe aperture and connect the pipe to the valve. Torque load the union nut to between 75 and 125 lbf in (0.845 to 1.413 mdaN).

(4) Test the valve.

(5) Refit access panel 153 BB.

AMBIENT SENSE LINE DRAIN VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The ambient sense line drain valve is bolted to the lower fuselage skin immediately to the left of the scavenge tank. The valve is operated from outside the fuselage by the insertion of a water drain tool.

Access to the valve and pipe connections is provided by access panel 153 BB (Ref. Removal/Installation).

Functional and Leakage Tests are given below. Operational and System Tests are not applicable to this topic.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
R Water drain tool	D925097000

B. Test

(1) Insert the water drain tool, open and close the spring-loaded valve and check that the valve action is smooth. Remove the tool.

3. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a pressure of 0 - 10 psig (0 - 0.68 bar)	-
Plug adapters (2), for vent ambient sense line	E925054000

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare

(1) Fit one plug adapter to blank the ambient sense line vent on one side of tank 11.

(2) Fit the other plug adapter to the ambient sense line vent on the opposite side of tank 11 and connect the air supply rig to the adapter.

(3) Trip the OVERFLOW RELIEF VALVE circuit breaker Q721 on panel 1-213, map ref.K15; fit a safety clip.

(4) Check visually that the valve is closed.

(5) Open the valve access panel 153 BB.

C. Test

(1) Apply a pressure of 3 psig (0.204 bar) to the ambient sense line. Check, in accordance with 20-23-12, that there is no leakage at the valve-to-pipe connections.

D. Conclusion

(1) Release the pressure on the sense pipe and disconnect the air supply rig. Remove the plug adapter.

(2) Remove the other plug adapter from the opposite side of tank 11.

(3) Refit the access panel.

(4) Remove the safety clip and reset the circuit breaker tripped before the test.

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AMBIENT SENSE LINE DRAIN VALVE - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

The ambient sense line drain valve is fitted to the bottom fuselage skin, on the right of the fuselage centre line, near the scavenge tank. The valve is operated from outside the fuselage by the insertion of a water drain tool.

2. Check

A. Equipment and Materials

DESCRIPTION	PART NO.
Water drain tool, ambient sensing	D925097000

B. Check

(1) Insert the water drain tool and push open the spring-loaded valve. Allow any accumulated water to drain from the ambient sense line. Remove the tool, checking that the valve returns to its seat under spring pressure.

SCAVENGE TANK - CLEANING/PAINTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 701)

This Cleaning/Painting procedure covers the cleaning of the scavenge tank interior and the action to be taken in the event of microbial contamination of the tank.

Cleaning the tank is accomplished by removing as much foreign matter as is possible by hand, and afterwards, by flushing the tank with fuel until all residue of foreign matter has been removed.

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In all cases of suspected or confirmed contamination it is essential
R that all relevant information is immediately forwarded to the Chief
R Engineer Concorde, Customer Support, BAE SYSTEMS (Airbus), New Filton
R House, Bristol BS99 7AR who will initiate an investigative procedure
to provide the remedy best suited to the reported defect.

2. Tank Cleaning

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
RB Eurotwill cloth	-
Cleaning solvent (Ref. 20-30-00, No.473)	-
Suitable hand fuel syringe/spray	-
Assorted bristle brushes of various sizes and grades, required to clean interior of tank	-
Lubricant, for O-ring seal	-
Torque spanner, 15 to 20 lbf in (0.169 to 0.226 mdaN)	-
Probe lamp or hand torch	-

DESCRIPTION	PART NO.
Drain valve spanner	D925436000
Fuel drain tool	D925374000
Container, 10 gal (45 l) capacity, for collecting fuel drained from the scavenge tank	-
Bonding lead, for container	-

B. Prepare to Clean Tank (Ref. Fig. 701)

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Trip the following circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
OVERFLOW RELIEF VALVE SUP & IND	1-213	Q 721	K15
SCAVENGE PUMP SUP	14-216	Q 491	E 4
TRIM PIPE DRAIN VALVES SUP & IND	15-215	Q 701	G22
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

(3) Remove access panels 153 AB and 153 BB.

(4) Place a clean container of approximately 10 gal (45 l) capacity under the scavenge tank drain. Electrically bond the container to the aircraft.

(5) Using the fuel drain tool (Ref. 28-25-00, Servicing), drain the tank fuel contents into the container.

(6) Remove the tank drain valve (Ref. 28-11-11).

(7) Examine the contents of the container for freedom from the type of debris that might indicate a fuel system defect.

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(8) Remove the scavenge pump and the scavenge pump mounting plate (Ref. 28-12-59) in order to facilitate cleaning the tank interior.

(9) Remove the bolts securing the access cover at the forward end of the scavenge tank.

(10) Remove the access cover and remove and discard the O-ring seal from its groove in the cover.

C. Clean Tank

(1) Through the tank access port, remove by hand any foreign matter from the tank interior and examine it for freedom from the type of debris that might indicate a system defect.

(2) Examine the interior of the tank, using the probe lamp or torch, for freedom from fungoid growth. When contamination is suspected or doubtful deposits exists, comply with the instructions in 12-32-00, Microbial Contamination of Fuel Tanks.

RB (3) Using Eurotwill cloth, mop out the tank interior, taking care to avoid break-up of cleaning cloth. If this should occur, ensure that all particles are removed. Use a suitable cleaning brush for narrow or remote areas of the tank.

(4) Flush the interior wall of the tank with clean fuel, using a suitable spray or syringe through the access port.

RB (5) Clean the access cover with BAC M302 solvent, applied with Eurotwill cloth. Wipe the surface dry immediately, before it 'air-dries'.

D. Conclusion

(1) Install the tank drain valve (Ref. 28-11-11).

R (2) Ensure all tools, equipment and cleaning materials have been
R removed from the tank.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

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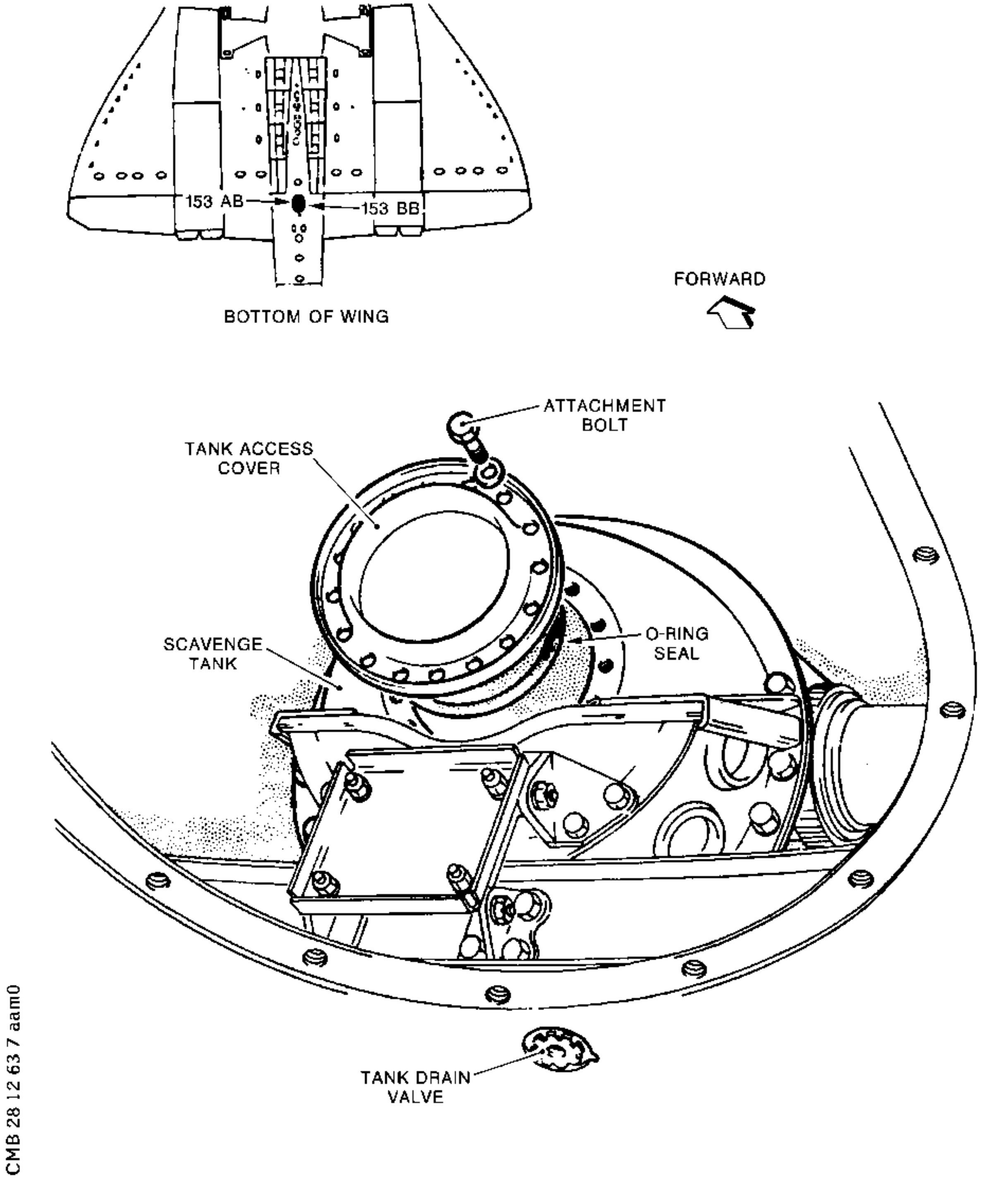

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Scavenge Tank
Figure 701

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Refit the scavenge pump mounting plate and scavenge pump (Ref. 28-12-59).

R (5) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the access cover.

R (6) Secure the access cover to the tank with bolts. Torque-tighten each bolt to between 15 and 20 lbf in (0.169 and 0.226 mdaN).

R (7) Carry out a Leakage Test of the scavenge tank (Ref. 28-12-59, Adjustment/Test).

3. Microbial Contamination

(1) If a detailed analysis of a fuel/water drain sample or swab confirms the existence of microbial contamination, one or more of the following procedures will be required to be implemented in accordance with recommendations received from the appropriate rectification authority.

(a) Detailed tests of drained water/fuel samples taken from all other tanks.

(b) Detailed inspection of other fuel tanks, and in particular, the associated tank No.3.

(c) Cleaning affected parts of the system (Ref. para.2., also 28-11-00, Cleaning/Painting).

(d) Repairs/replacement to corroded areas/parts of the system in accordance with instructions issued in respect of the particular component or structural defect.

(e) Sterilization of the system (Ref. 28-11-00, Cleaning/Painting).

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DE-AERATION SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

All aircraft fuel contains a certain amount of air held in solution in the fuel. The quantity of air in solution in the fuel decreases as tank pressure falls during climb, and the release of this excess air can cause pump cavitation. Sudden release of air at altitude may cause momentary increases in tank pressure and fuel overflow into the vent gallery. To avoid these undesirable effects, the fuel in tanks which remain full during climb (tanks 5A, 6, 7A, 8, 10 and 11) is de-aerated by circulation through an arrangement of small bore pipes, filters and spray nozzles in the tanks, using either transfer pumps or, in tank 10, a separate de-aeration pump.

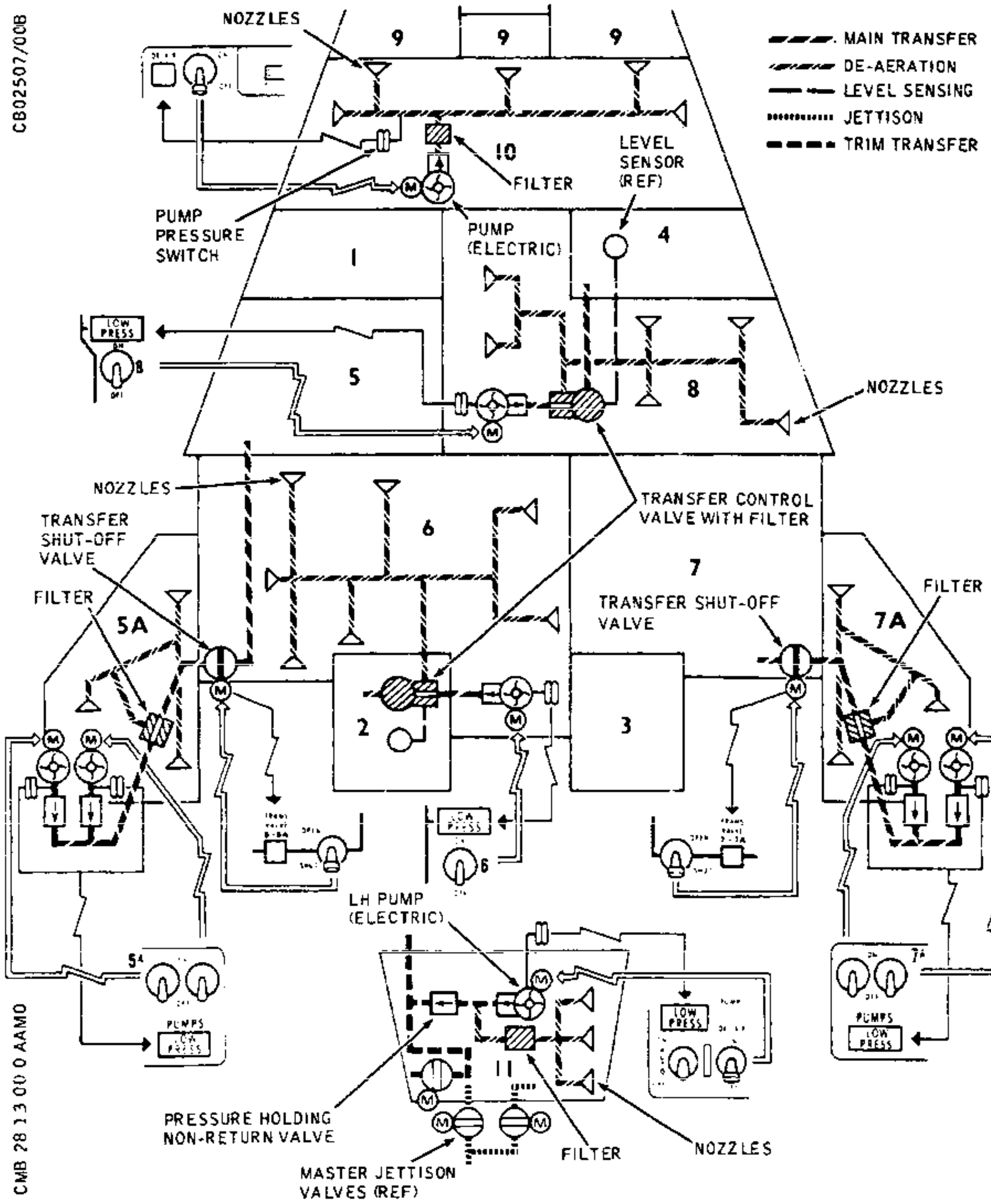
The low pressure encountered by the fuel in passing through the spray nozzles causes some air to be released into bulk fuel as a cloud of small bubbles which form nuclei for the release of supersaturating air and therefore maintain the bulk fuel in an equilibrium condition and prevent a rapid release of air from the fuel.

The de-aeration piping in each tank is in the form of a main pipe which branches into shorter pipes terminating at a number of small nozzles at various positions in the tanks. In tanks 5A, 6, 7A and 8 the main de-aeration pipe is a branch pipe taken from a main transfer pipe; in tank 11 the main de-aeration pipe is a branch pipe taken from the trim transfer pipe between the pump outlet and the pressure holding non-return valve; in tank 10, the main de-aeration piping is taken directly from the de-aeration pump and forms a completely independent system.

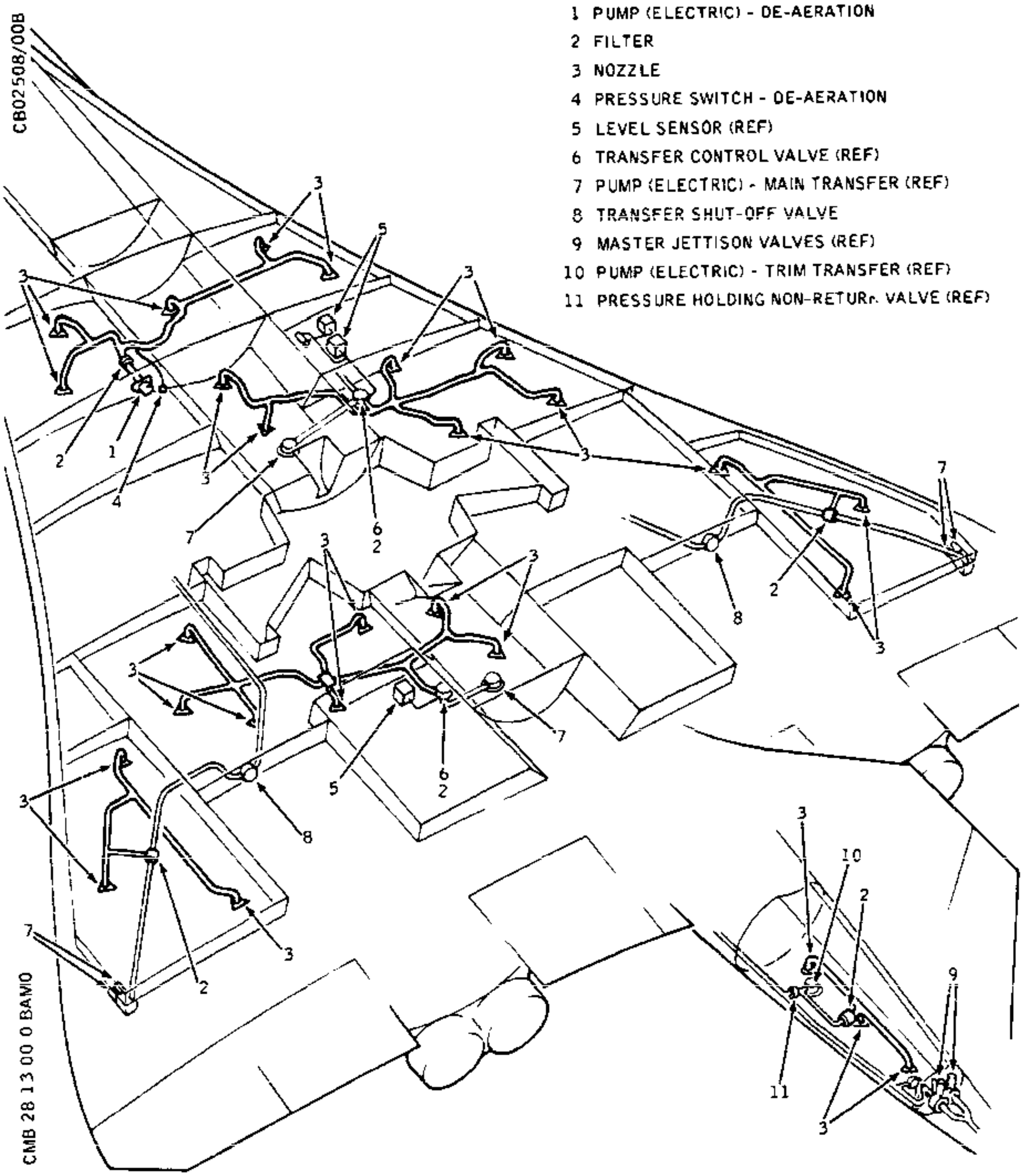
The de-aeration pump in tank 10 is mounted below the left-hand cell of the tank in the underwing fillet. The pump mounting incorporates spring-loaded flap valves to enable the pump element to be removed without defuelling the tank. A pressure switch connected to the pump outlet pipe, downstream of the filter, signals the operational condition of the pump.

De-aeration in tank 11 is carried out using the left-hand electric pump. A separate switch is provided on the fuel management panel for use on occasions when the pump is being used for de-aeration.

Two motorized transfer shut-off valves are fitted in the 5A-5 and 7A-7 main transfer pipes. When these valves are closed, fuel transfer is prevented, allowing de-aeration in tanks 5A and 7A to be carried out, using the tank pumps.



R - De-aeration System - Schematic
Figure 001



R - De-aeration System - Component Location
Figure 002

A nozzle is fitted at the end of each branch pipe to direct jets of fuel into the tanks. The nozzles are fitted so that each jet has an unrestricted flow path.

The control switches and indicators for the transfer pumps and the de-aeration pump and valves are on the fuel management panel at the third crew member's station.

2. Pump Unit - Tank 10 (Ref. Fig. 003)

The pump element is bolted to a mounting plate which incorporates inlet and outlet non-return valves and a vapour vent valve. The inlet non-return valve and vapour vent valve are held open by the pump element inlet housing and are closed, by spring pressure, over the inlet and vent outlet when the element is removed. The outlet non-return valve opens, by fuel pressure, when the pump is operating, and closes, by spring pressure, to prevent reverse fuel flow when the pump is removed.

The pump draws fuel from the tank, through the inlet, and delivers the fuel into the de-aeration pipe, which is bolted and sealed to the mounting plate outlet port.

The pressure switch sense line connects into this pipe, downstream of the filter. A drain plug enables the pump casing to be drained prior to pump removal.

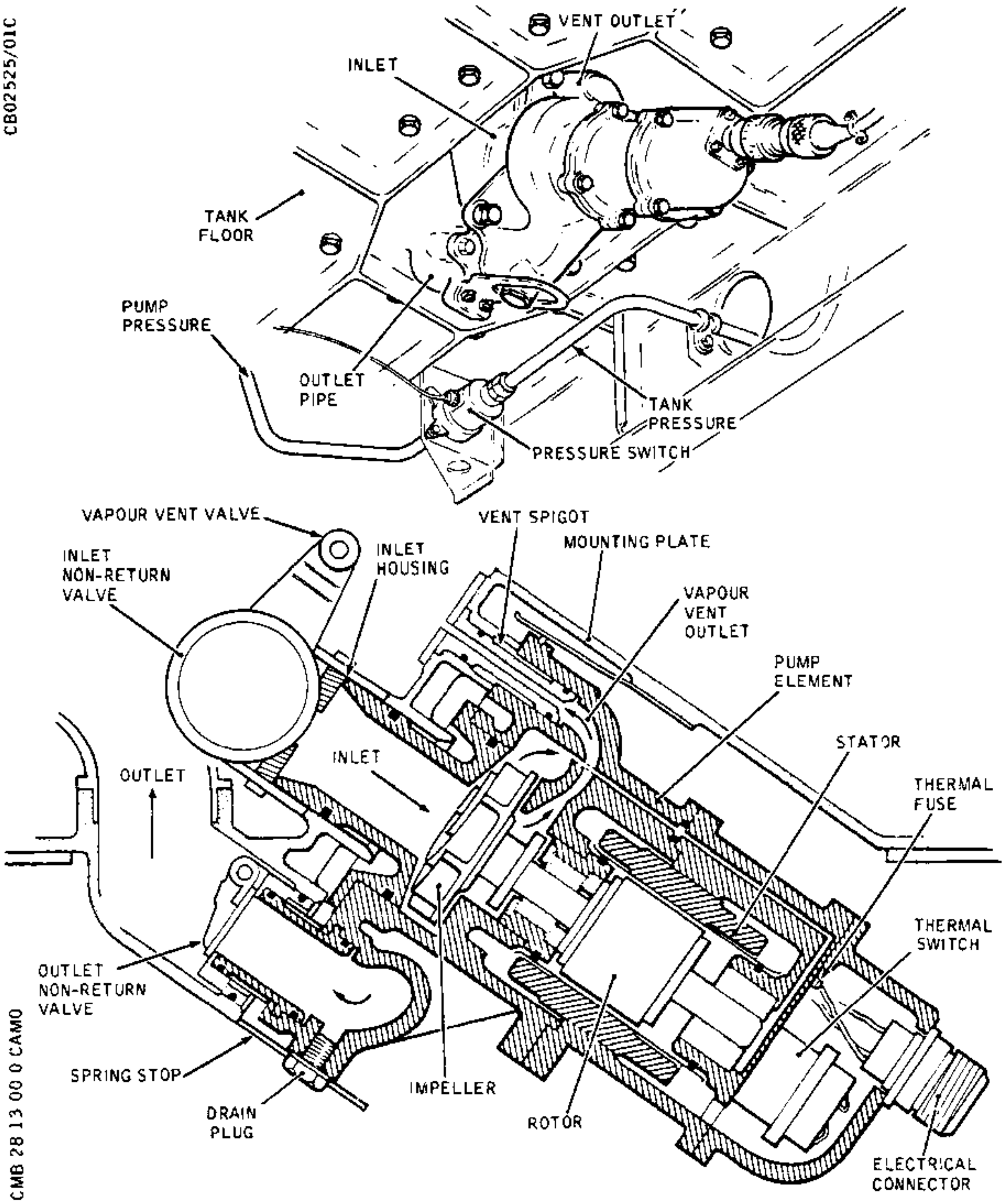
The pump element is a low pressure centrifugal type, driven by an electric motor using 200 V three-phase a.c. power, controlled by a separate switch. Some of the fuel being pumped is circulated through the pump casing and bearings to serve as a coolant and lubricant for the motor. The circulated fuel, together with any fuel vapour produced by the impeller, is vented back into the fuel tank.

The motor is protected against overheating by a thermal switch, which will switch the motor off and on within a preset temperature range. A thermal fuse is a further protection against overheating. If the fuse fails a new pump element must be fitted.

3. Pump Pressure Switch (Ref. Fig. 004)

Indication of the operating condition of the de-aeration pump is given by a two-position, ON - OFF, magnetic indicator on the fuel management panel, operated by a pressure switch. The switch is mounted in the LH underwing fairing immediately forward of the pump.

The switch has a sealed microswitch, actuated by linkage via



R De-aeration Pump - Tank 10
Figure 003

R a diaphragm. The diaphragm senses pump outlet pressure and
R tank fuel pressure via small-bore piping. When the pump
R outlet pressure rises to 15 psig (1.034 bar) (maximum), the
R switch contacts close to complete the indication circuit and
R the magnetic indicator displays ON. The switch contacts open
R when the pump pressure falls to 12.5 psig (0.862 bar)
R (minimum) and the magnetic indicator displays OFF.

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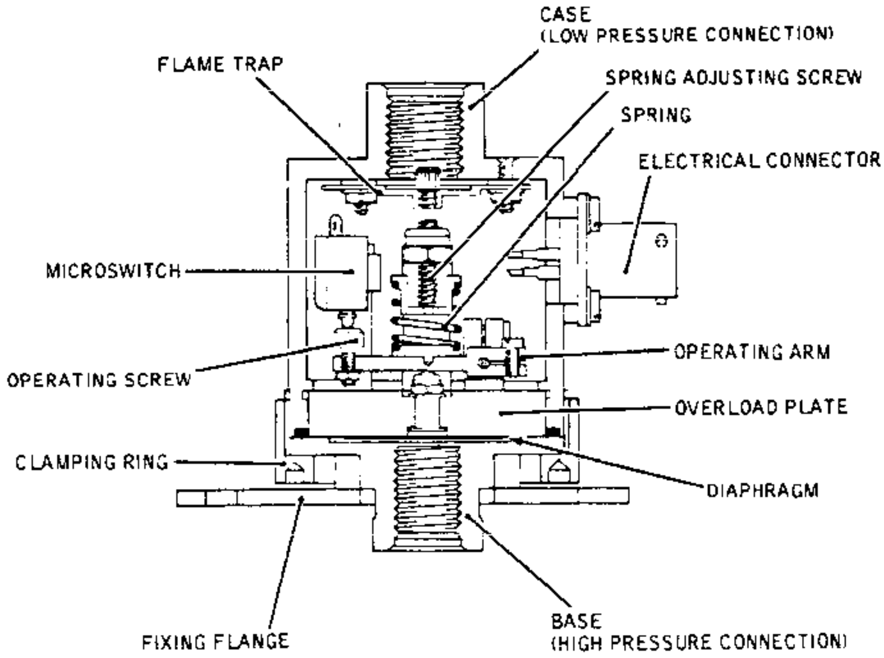

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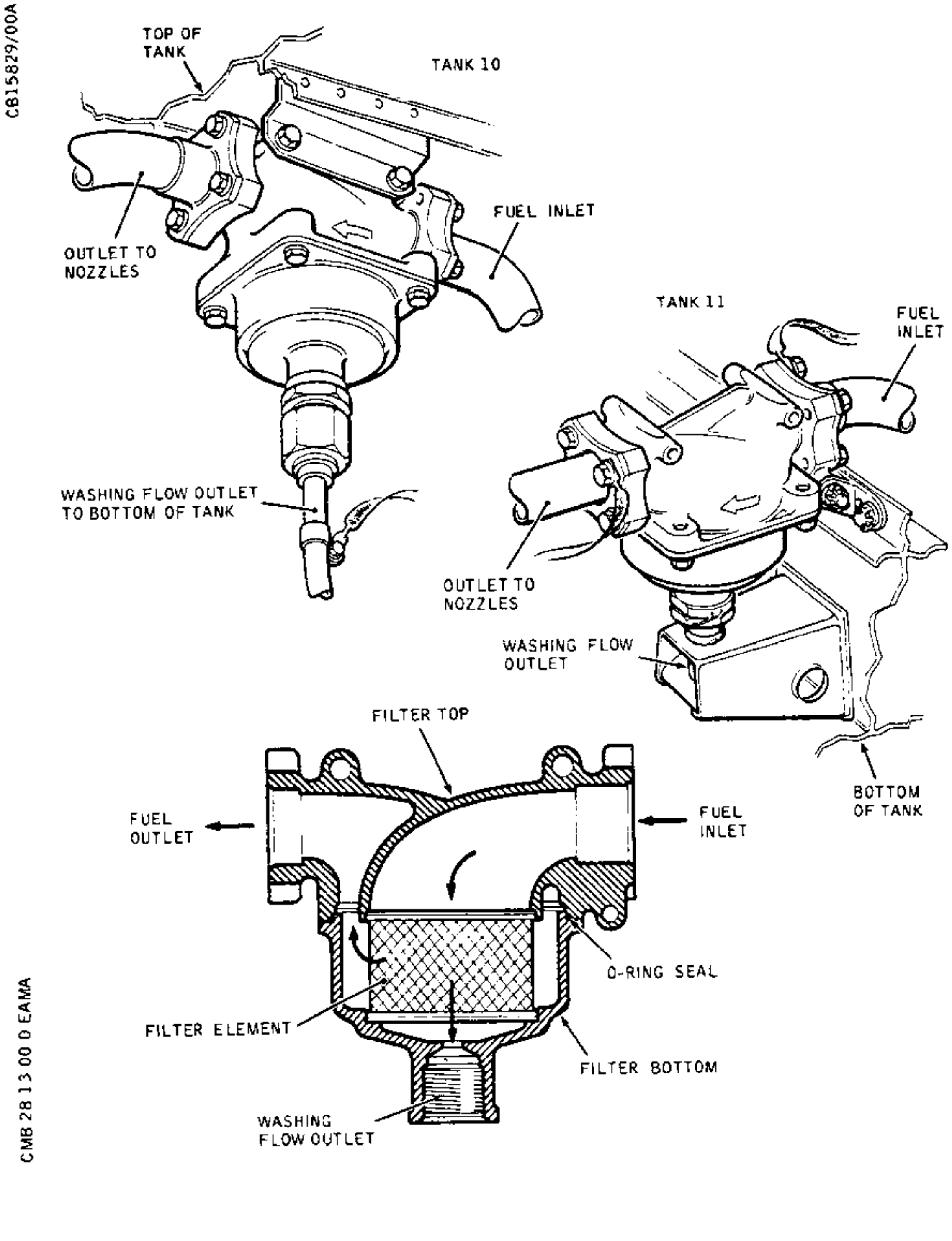
Pump Pressure Switch
R Figure 004

R 4. <u>Nozzles</u>

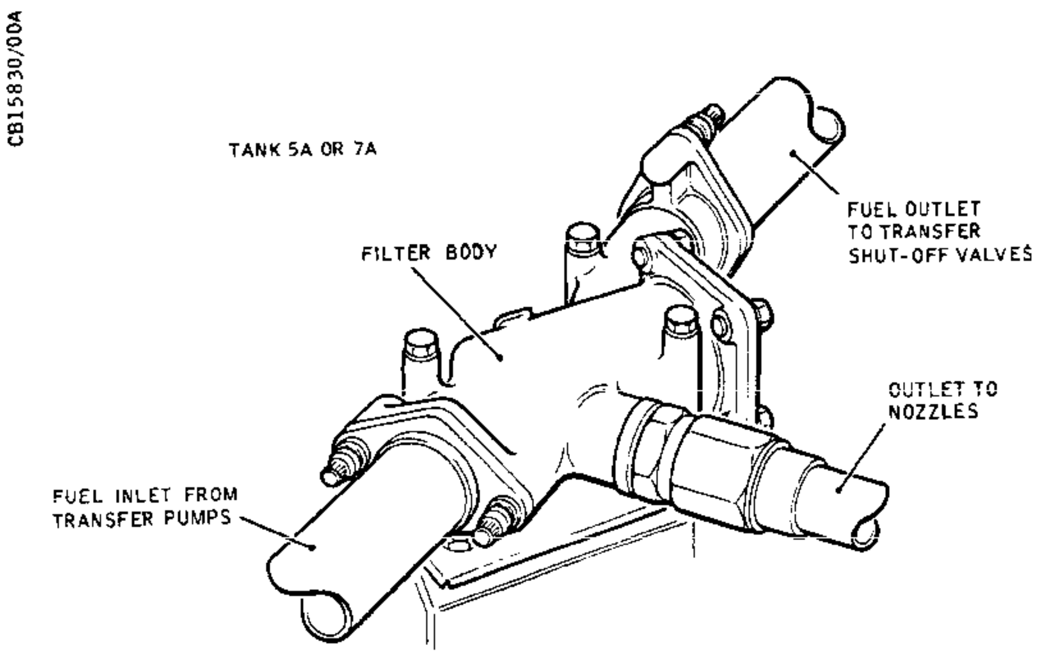
R The nozzles are removable hexagon-headed plugs with the interior machined and a hole drilled in each flat of the head to create six horizontal jets of fuel. A drain hole
R is provided in the base of the nozzles to prevent accumulation
R of water. The nozzles are mounted on brackets near the tank floors.

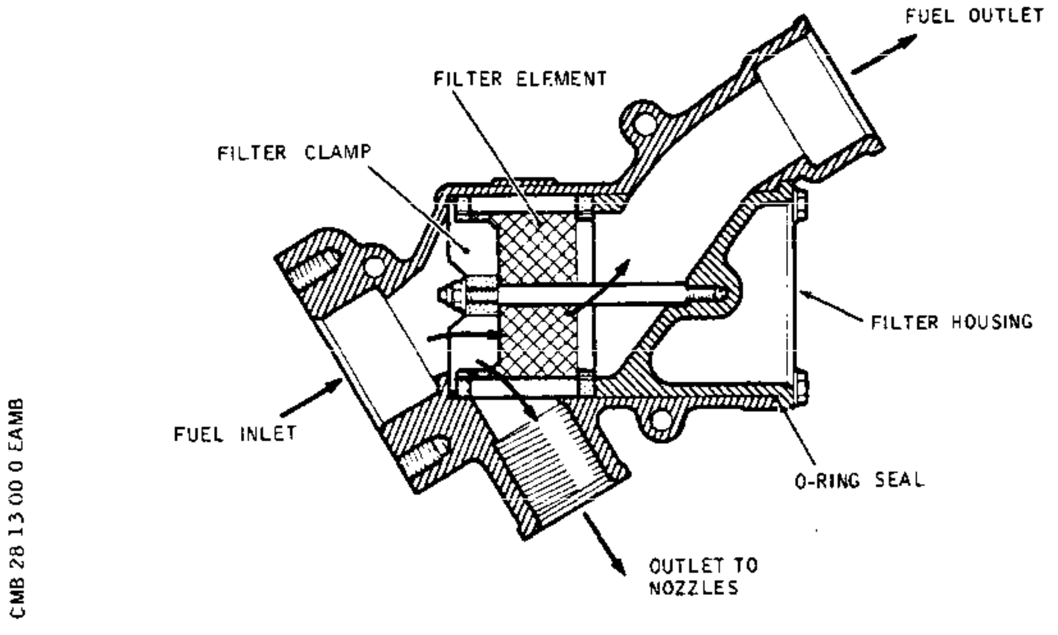
R 5. <u>Filters</u> (Ref. Fig. 005)

The filter installations in the various tanks operate on the
R 'washed flow' principle.



\- De-aeration Filters (Sheet 1 of 3)
R Figure 005





R De-aeration Filters (Sheet 2 of 3)
Figure 005

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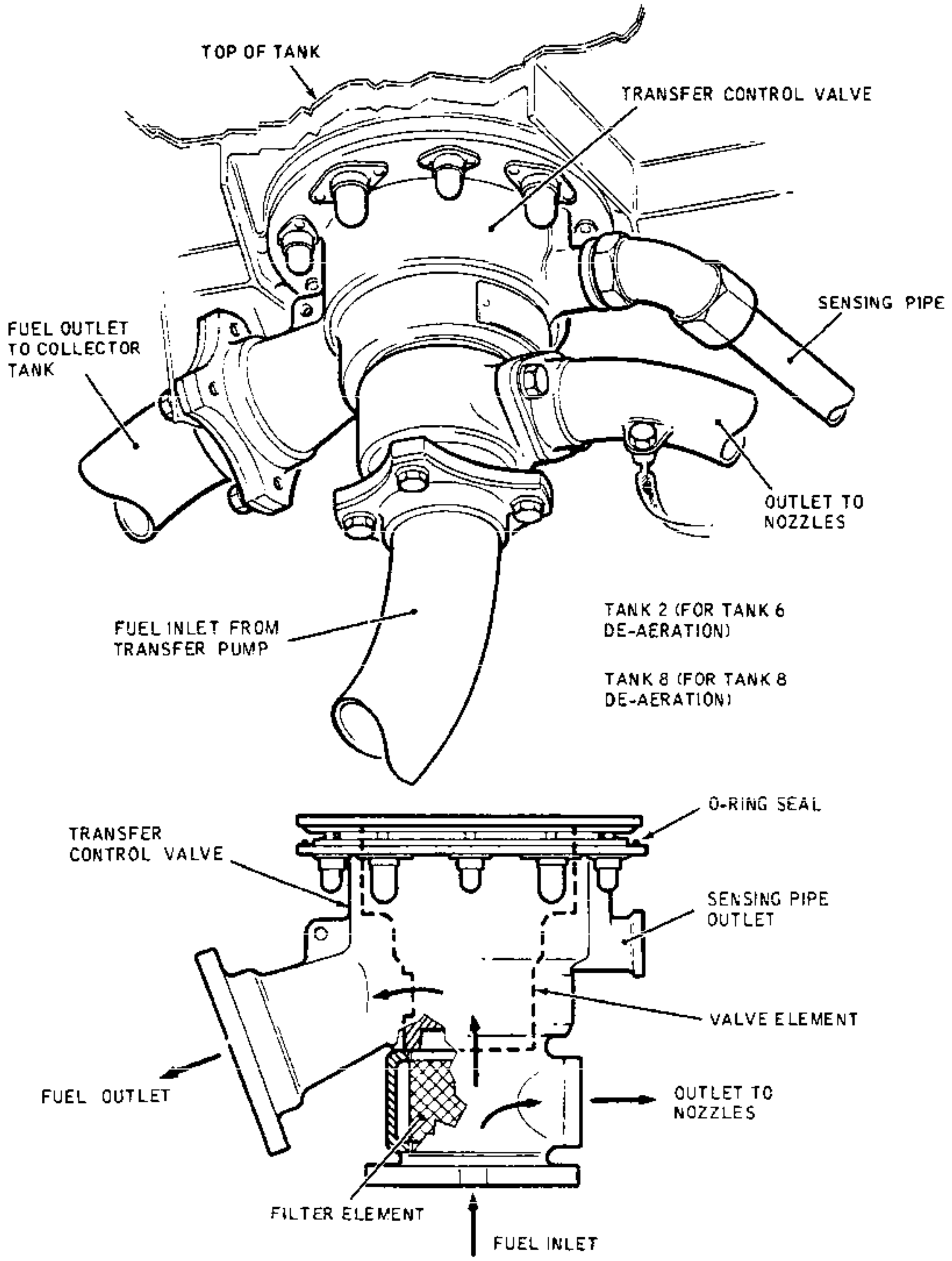

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R De-aeration Filters (Sheet 3 of 3)
Figure 005

The filter units in tanks 10 and 11 are mounted in the de-aeration piping and have detachable lower housings containing the filter elements.

Fuel from the pump enters the filter unit via an inlet port and flows across the filter element to the de-aeration flow outlet port and then to the spray nozzles. The filter element is washed clean by allowing part of the inlet supply to pass through the centre of the element and back into the tank via a washing flow outlet port.

The filter elements are accessible through adjacent access panel apertures after tank 10 has been partially drained, or tank 11 fully drained, and the filter lower housing detached.

Filter units in tanks 5A and 7A are mounted in-line in the main transfer pipes and comprise a body and a detachable filter element assembly. The main transfer flow from the pumps passes through the centre of the filter element and acts as the washing flow to clean the filters. Part of the main transfer flow passes across the filter element to the de-aeration outlet port and spray nozzles. The filter assemblies are accessible through adjacent access panels in the tank upper skin after the tank has been partially drained. The filter assembly is removed after its four attachment bolts have been removed. With the assembly removed, the filter element can be detached after removing a securing nut.

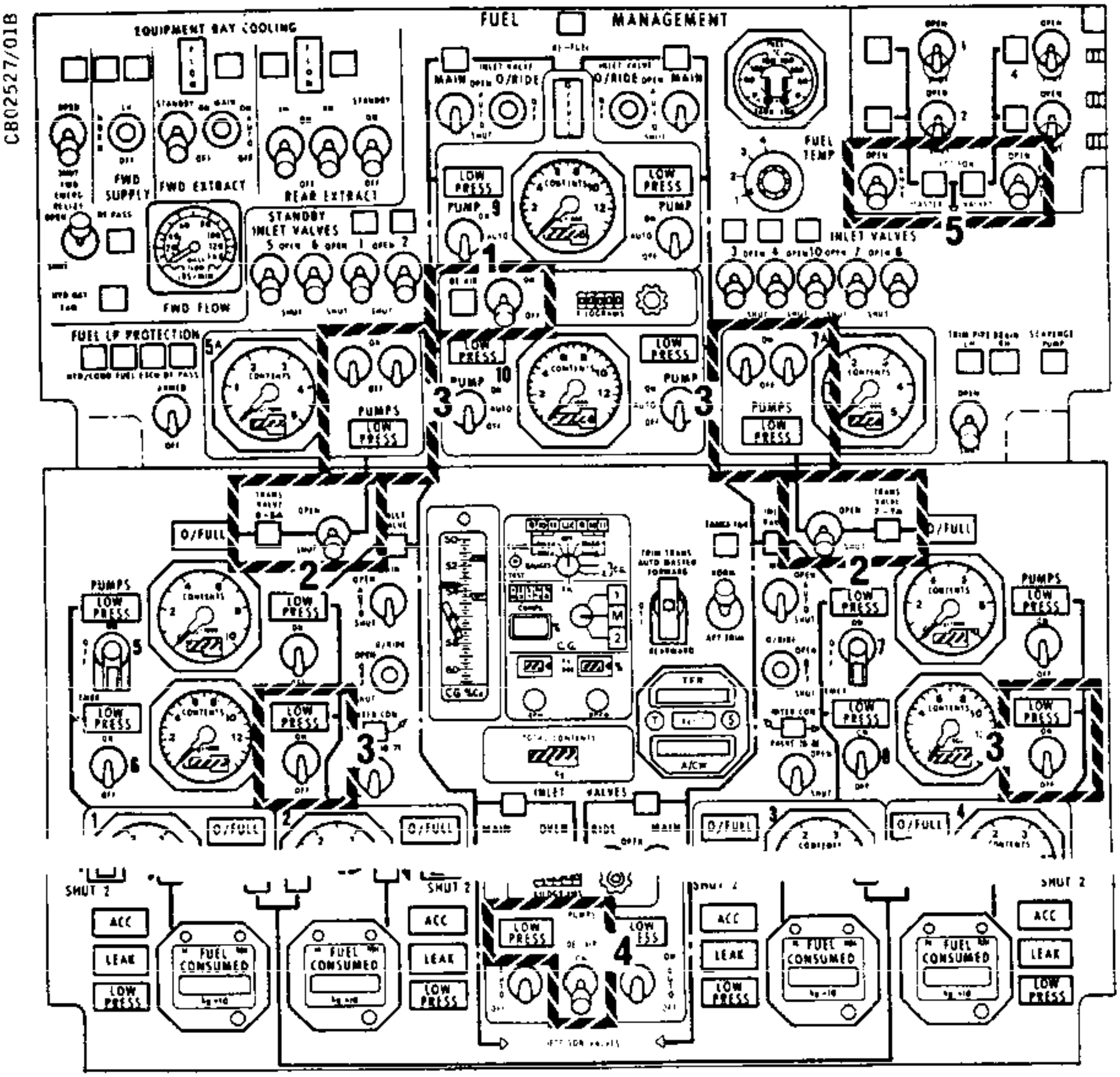
For tanks 6 and 8, only the basic filter element is used. The element is mounted in the inlet port of the appropriate transfer control valve. The main transfer flow passes through the centre of the filter element and out through the de-aeration tapping to the spray nozzles. The filter element can be removed from the transfer control valve housing after removal of the transfer control valve element.

Because of the washing action, the filters should not need cleaning. There is no indication of blockage, except in tank 10; if tank 10 filter is found to be blocked, all filters must be inspected.

6. Operation (Ref. Fig.006 and 007)

The control switches and indicators for the de-aeration system are on the fuel management panel at the 3CM station.

De-aeration in tank 10 is effected by switching on the de-aeration pump, which is controlled by a switch via a control relay, and fuel is sprayed through the de-aeration nozzles. The switch is a two-position, ON - OFF, 'locked toggle' type, which has to be pulled out before it can be

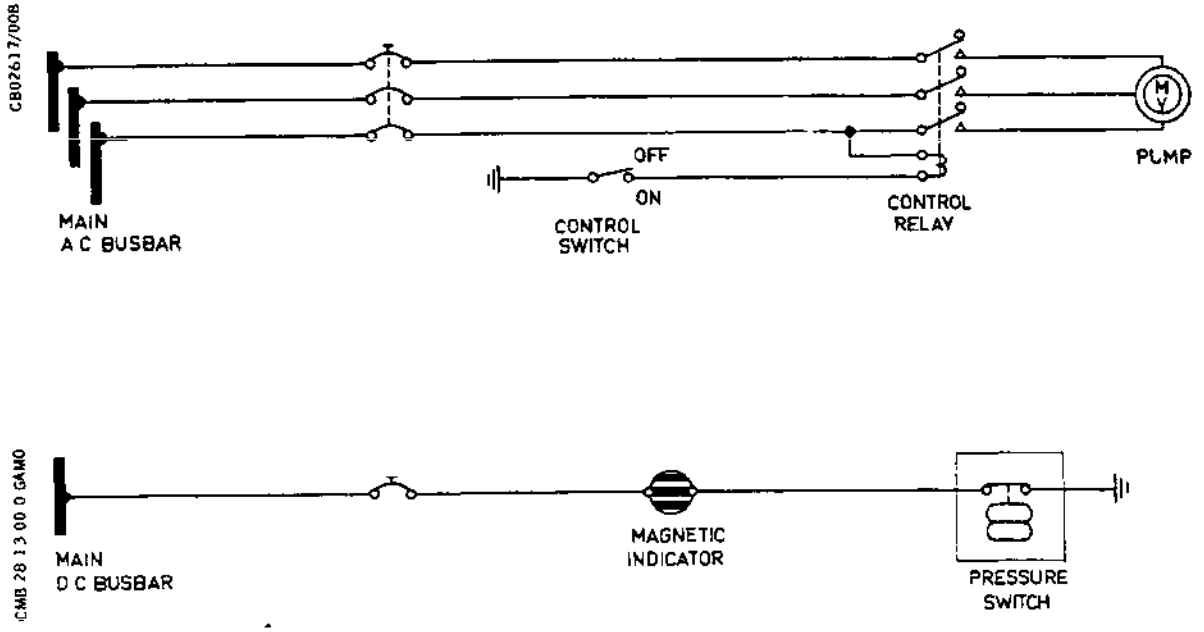


1 DE-AERATION PUMP - CONTROL SWITCH AND INDICATOR
2 TRANSFER SHUT-OFF VALVES - CONTROL SWITCHES AND INDICATORS
3 MAIN TRANSFER PUMPS - CONTROL SWITCHES AND CAPTION LIGHTS
4 TANK 11 LH ELECTRIC PUMP - CONTROL SWITCH AND CAPTION LIGHT (WHEN USED FOR DE-AERATION)
5 MASTER JETTISON VALVES - CONTROL SWITCHES AND INDICATORS

CMB 28 13 00 0 FAMO

- De-aeration System - Controls and Indicators
Figure 006

R



\- De-aeration Pump - Control and Indication -
Schematic Diagram
Figure 007

moved. An associated two-position magnetic indicator shows ON when the pump is delivering fuel at a pressure of 15 psig (1.034 bar) and OFF either when the pump is switched off or if the pump is delivering fuel at pressure below 12.5 psig (0.862 bar).

De-aeration in tanks 5A and 7A is carried out by operating one or both of the transfer pumps in the tanks. When the pumps are switched on, and the transfer shut-off valves are closed, fuel is sprayed through the de-aeration nozzles. Each pump is controlled by an ON - OFF switch with a single LOW PRESS caption common to both pumps in a tank. Transfer of fuel out of the tanks is prevented by the transfer shut-off valves (Ref. 28-22-00), which are closed during the climb while de-aeration is in progress.

De-aeration in tank 11 is achieved by operating the left-hand electric pump in the tank. A separate switch is provided on the fuel management panel for use when the pump is being used for de-aeration. The switch is a two-position, ON - OFF, 'locked toggle' type, which has to be pulled out before it can

R can be moved. A relay is incorporated in the switch circuit
R (Ref. 28-23-00, Description and Operation) to ensure that the
pump cannot be used for de-aeration purposes when rearward fuel
R transfer takes place. When the pump is switched on,
R fuel is supplied to the spray nozzles from the trim transfer
R pipe. Indication of pump pressure is displayed by a LOW PRESS
caption.

Fuel in tanks 6 and 8 is not used until cruise and de-aeration
is effected by switching on one main transfer pump in
each tank during climb. The pumps used for this purpose
R are the short-line ones, i.e., tank 6 pump supplying tank 2
and tank 8 pump supplying tank 4. Each pump supplies fuel
to the nozzles in its tank and keeps the air dissolved in
the fuel to an equilibrium condition. Transfer out is
prevented by the appropriate level sensor in the associated
R collector tank. Each pump is separately controlled by a two-
R position, ON - OFF switch and pump pressure indication is
R displayed by a LOW PRESS caption.

R 7. Electrical Power Supplies

The electrical power supplies for the de-aeration pump and transfer shut-off valves are detailed in Table 1.

SERVICE	BUSBAR	CB PANEL
De-aeration pump:		
Supply	No.4 main 200 V a.c. 4X	14-216
Indication	'B' main 28 V d.c. 2P	15-216
Transfer shut-off valves:		
Tank 5A-5	'A' main 28 V d.c. 1P	15-215
Tank 7A-7	'B' main 28 V d.c. 2P	15-216

Electrical Supplies
Table 1

DE-AERATION SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE GENERAL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Preparation

A. Ensure that the circuit breakers are set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Obtain a stopwatch for use during the test (Ref. para.3.).

3. Trouble Shooting - No.10 Tank

A. Prepare to trouble shoot (Ref. para.2.). At the 3CM station, panel 2-214, set the de-aeration pump control switch to "ON". Check that the associated indicator shows ON within 3 s, and circuit breakers remain set. IF -

- OK — go to B.
- NOT OK —
  1. Circuit breaker trips when system on - Chart 101.
  2. Indicator shows OFF with de-aeration pump switched on - Chart 102.

B. Continue to run pump for 10 min to check that pump motor overheat switch does not operate. IF -

- OK — go to C.
- NOT OK — If pump motor stops within 10 min, renew Pump (7).

C. Switch off pump control switch and check that indicator shows OFF within 2 s.

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CIRCUIT BREAKER TRIPS WHEN SYSTEM ON.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

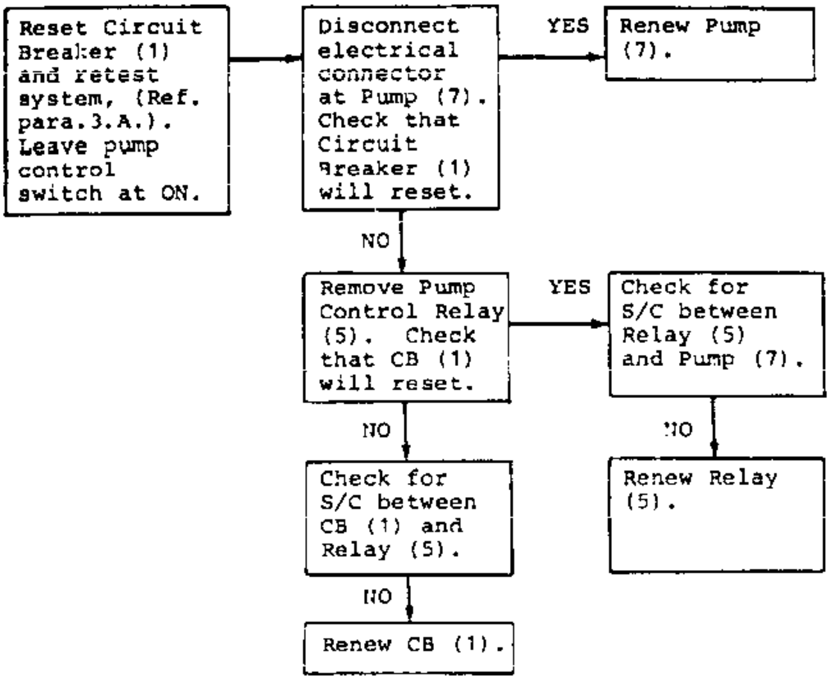

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Chart 101

INDICATOR SHOWS 'OFF', WITH DE-AERATION PUMP SWITCHED ON.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the preceding run of wiring for continuity.

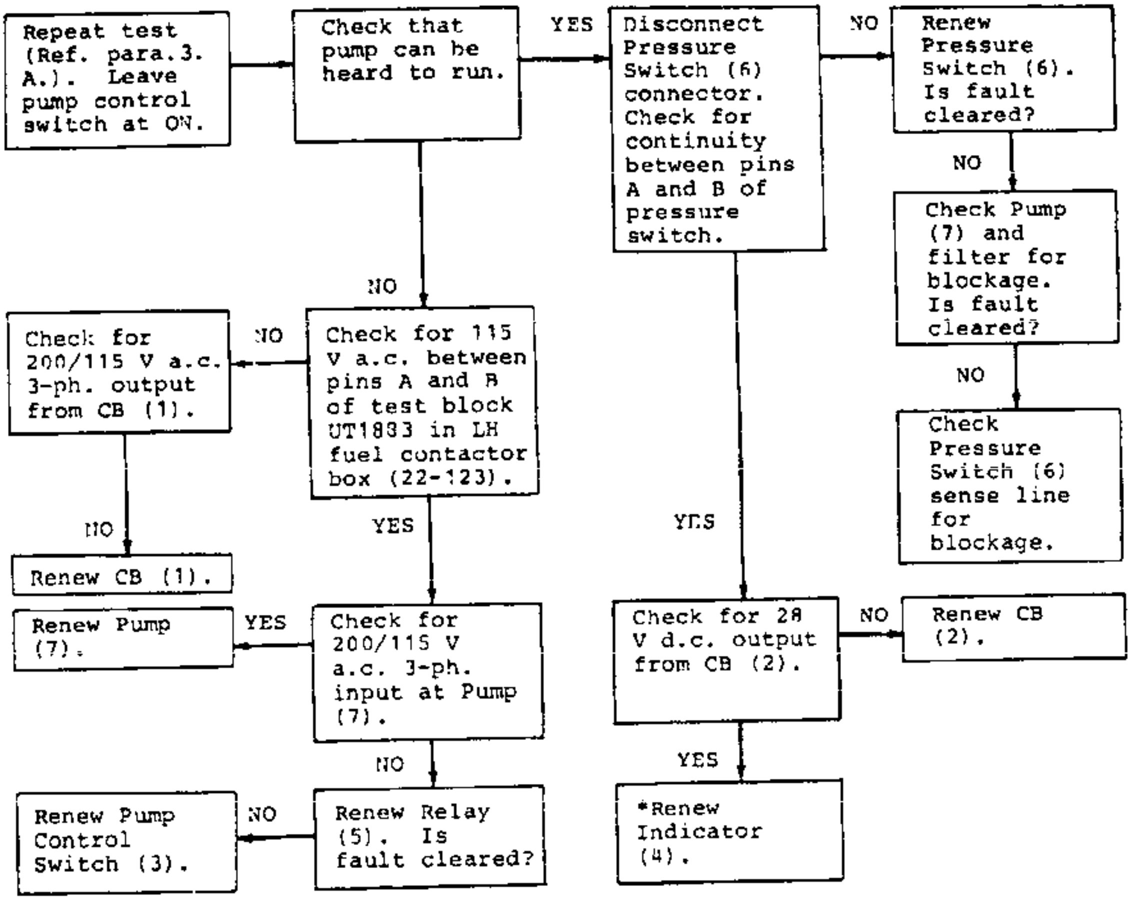

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Chart 102

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1) Circuit breaker 200/ 115 V	-	14-216	Q6666	Map ref.F7	24-50-00 R/I	28-13-01
(2) Circuit breaker 28 V	-	15-216	Q6667	Map ref.E7	24-50-00 R/I	28-13-01
(3) De-aeration pump control switch	-	2-214	Q6670	3CM station		28-13-01
(4) De-aeration pump indicator	-	2-214	Q6674	3CM station		28-13-01
(5) De-aeration pump control relay	-	22-123	Q6679	LH fuel contactor box, fwd. under-floor racking		28-13-01
(6) Pressure switch	PB	191	Q6683	No.10 tank centre cell, LH	28-13-14 R/I	28-13-01
(7) De-aeration pump	RB	191	Q6680	No.10 tank centre cell, LH	28-13-11 R/I	28-13-01

Component Identification
Table 101

DE-AERATION SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig.501)

De-aeration of fuel in tanks 5A, 6, 7A, 8 and 11, is achieved by using the main and trim transfer systems in these tanks.

In tank 10, the de-aeration piping is taken directly from a de-aeration pump, thus forming a completely independent system. The DE-AIR pump switch for this system is mounted on the fuel management panel (3CM position).

De-aeration in tank 11 is achieved by using the LH electric pump. A DE-AIR pump switch, on the fuel management panel, is provided for use when the pump is being used for de-aeration.

This topic comprises an Operational Test, applicable to the pumps in tanks 10 and 11, and Leakage and Functional Tests for de-aeration pipelines and components in all the associated tanks.

An Operational Test is not applicable to any part of the de-aeration system other than tanks 10 and 11, and a System Test is not applicable to any part of the system.

The filters used in the system should not normally require cleaning. There is no indication of filter blockage except in the case of tank 10. If the filter in tank 10 is blocked, all the filters must be inspected (Ref. 28-13-16, Removal/Installation, and 28-22-12, Removal/Installation).

2. Operational Test - Tank 10 or 11

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check, by reference to the fuel quantity indicators, that tank 10 or 11, as appropriate, contains fuel.

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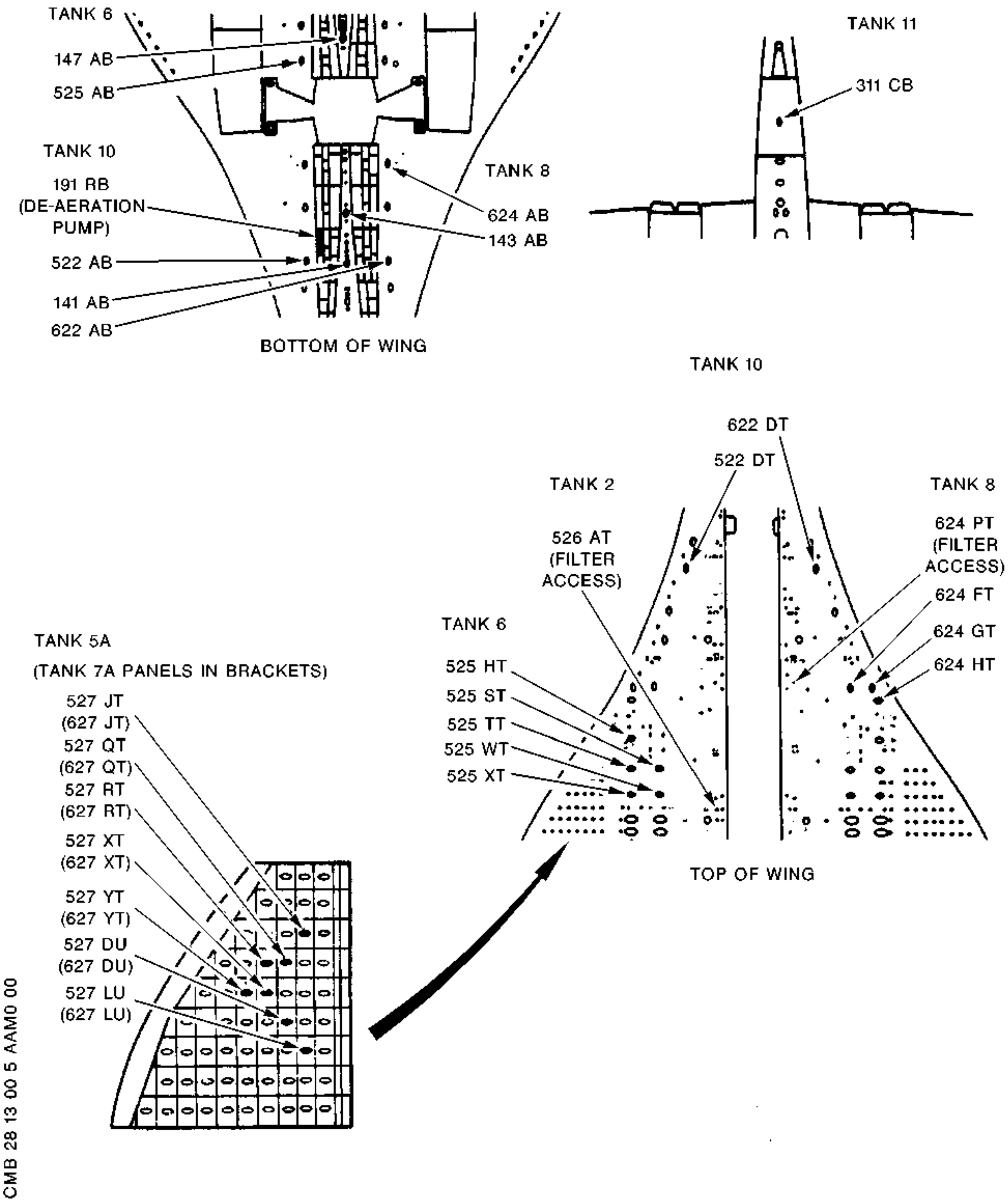

Access Panels - De-aeration System
Figure 501

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B. Test

(1) If testing the system in tank 10, proceed as follows:

(a) Set the DE-AIR switch for tank 10 de-aeration pump to "ON". Check that the associated magnetic indicator displays ON within 3 s.

(b) Set the switch to "OFF" and check that the indicator displays OFF.

(2) If testing the system in tank 11, proceed as follows:

(a) Set the DE-AIR switch for tank 11 pump to "ON". Check that the LH LOW PRESS caption is illuminated and then extinguished after 3 s as the pump pressure builds up.

(b) Set the switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

3. <u>Leakage Test - Tank 5A or 7A</u>

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and adapter	E925103000
Fuel pressure test rig, capable of producing a pressure of 0 to 25 psig (0 to 1.72 bar)	-
Standard AN blanks, for de-aeration nozzles	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

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(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check that the appropriate TRANS VALVE (5A-5 or 7A-7) indicator displays bar-across-line.

(4) Drain the tank (Ref. 28-25-00).

(5) Remove the appropriate tank access panels (Ref. Table 501) (Ref. Fig.501), in the wing top surface, to obtain access to the de-aeration components and pipelines.

ACCESS PANEL TANK 5A	ACCESS PANEL TANK 7A	COMPONENT
527 XT	627 XT	Filter block
527 DU	627 DU	Junction block
527 QT	627 QT	3-way junction
527 RT	627 RT	Union
527 LU	627 LU	Nozzle
527 JT	627 JT	Nozzle
527 YT	627 YT	Nozzle

Access Panels and Associated Components
Table 501

(6) Remove one transfer pump element from its canister in the tank (Ref. 28-22-22).

(7) Fit the pump test element in place of the pump element, and connect the test rig to the adapter.

(8) Gain access to the tank (Ref. 28-10-00, Servicing), remove the de-aeration nozzles from the pipelines and fit standard AN blanks in place of the nozzles.

C. Test

(1) Operate the test rig and fill the system with fuel. Bleed off air by allowing fuel leakage at convenient nozzle blanks. Tighten the blanks.

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(2) Increase the pressure to 25 psig (1.72 bar) and check that all joints and pipes are free from leakage.

(3) Release the pressure and disconnect the test rig.

(4) Remove the pipe blanks and fit the de-aeration nozzles.

(5) Carefully examine all the holes in each de-aeration nozzle and ensure that they are free from blockage.

D. Conclusion

(1) Remove the pump test element and install the pump element (Ref. 28-22-22).

(2) Check for freedom from corrosion the mating surfaces of the wing and the access panels to be refitted. Fit the panels.

(3) Remove the placard from the fuel management panel.

(4) Refuel the tank (Ref. 12-11-28).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Functional Test - Tank 5A or 7A

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and adapter	E925103000
Combined fuel pressure and flow test rig, capable of delivering 20 gal/min (91 l/m) at a pressure of 25 psig (1.72 bar)	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the position of the switches must not be altered.

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

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(3) Check that the appropriate TRANS VALVE (5A-5 or 7A-7) indicator displays bar-across-line.

(4) Check, by reference to the fuel quantity indicators, that the tank has at least 100 gal (455 l) capacity, below high level, to receive the fuel required for the test.

(5) Remove one transfer pump element from its canister in the tank (Ref. 28-22-22).

(6) Fit the pump test element in place of the pump element and connect the test rig to the adapter.

C. Test

(1) Operate the test rig and supply fuel at 25 psig (1.72 bar) to the pump test element.

(2) Check that the fuel flow rate into the pump test element is 5.25 (±0.5) gal/min (24 (±2) l/min)).

D. Conclusion

(1) Release the pressure and disconnect the test rig

(2) Remove the pump test element and install the pump element (Ref. 28-22-22).

(3) Remove the placard from the fuel management panel.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R

R 5. System Test - Tank 6 or 8

R A. Tank 6

R (1) Prepare

R (a) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

R (b) Remove tank access panels 526 BT (tank 2), 525 UT and 525 LT (tank 6).

R (c) Make available electrical ground power as detailed in 24-41-00, Servicing.

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R (d) Fill tank 6 to 500 kg. This will place fuel in the fuselage section of the tank only.

R (e) Manually raise the sensor float in tank 2 in order to close the transfer control valve. Maintain the sensor in this position.

R (2) Test

R (a) On the fuel management panel set the tank 6-2 main transfer pump switch to "ON".

R (b) Observe equal flow from the de-aeration nozzles.

R (c) Ensure no leak from pipe joints.

R (d) On the fuel management panel set the tank 6-2 main transfer pump switch to "OFF".

R (3) Conclusion

R (a) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R (b) Lower the sensor float in tank 2.

R (c) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R <u>NOTE</u>: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (d) Examine for freedom from corrosion the mating surfaces of the tank access panels that were removed in para.A.(1) for component access. Fit the panels.

R (e) Remove the placard from the fuel management panel.

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R B. Tank 8

R (1) Prepare

R (a) Ensure that all fuel management panel switches are at
R their normal ground settings (Ref. 28-00-00, Servicing).
R Place a placard at the panel warning that the positions
R of the switches must not be altered.

R (b) Remove tank access panels 623 CT (tank 4), 624 BT and
R 624 JT (tank 8).

R (c) Make available electrical ground power as detailed in
R 24-41-00, Servicing.

R (d) Fill tank 8 to 500 kg. This will place fuel in the
R fuselage section of the tank only.

R (e) Manually raise the sensor float in tank 4 in order to
R close the transfer control valve. Maintain the sensor
R in this position.

R (2) Test

R (a) On the fuel management panel set the tank 8-4 main
R transfer pump switch to "ON".

R (b) Observe equal flow from the de-aeration nozzles.

R (c) Ensure no leak from pipe joints.

R (d) On the fuel management panel set the tank 8-4 main
R transfer pump switch to "OFF".

R (3) Conclusion

R (a) Switch off and disconnect electrical ground power as
R detailed in 24-41-00, Servicing.

R (b) Lower the sensor float in tank 4.

R (c) Prior to tank close-up, visually inspect all bonding
R leads to ensure their integrity.

R <u>NOTE:</u> Any bonding lead which is found to be broken,
R frayed, or with braid loose in the crimp is to
R be replaced before the next flight.

R Bonding leads which show signs of surface
R corrosion only (characterized by sooty deposits
R or tarnishing) may be left installed.

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R (d) Examine for freedom from corrosion the mating surfaces of the tank access panels that were removed in para. B.(1) for component access. Fit the panels.

R (e) Remove the placard from the fuel management panel.

6. Functional Test - Tank 6 or 8

R Test deleted.

7. Leakage Test - Tank 10

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and adapter	E925103000
Fuel pressure test rig, capable of producing a pressure of 0 to 25 psig (0 to 1.72 bar)	-
Standard AN blanks, for de-aeration nozzles and de-aeration pump filter outlet	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Drain the tank (Ref. 28-25-00).

(3) Remove the de-aeration pump element from its canister in the tank (Ref. 28-13-11).

(4) Fit the pump test element in place of the pump element and connect the test rig to the adapter.

(5) Remove the appropriate tank access panels (Ref. Fig.501) to obtain access to the de-aeration components and pipelines.

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(6) Gain access to the tank (Ref. 28-10-00, Servicing) and proceed as follows:

(a) Remove the de-aeration nozzles from the pipelines. Fit standard AN blanks in place of the nozzles.

(b) Disconnect the washing flow outlet pipe from the base of the filter (Ref. 28-13-16, Removal/Installation) and fit in its place a standard AN blank.

(c) Remove the filter outlet pipe (Ref. 28-13-16, Removal/Installation) and examine it for the presence of a 0.02 in (0.5 mm) dia. air bleed hole in the upper surface.

NOTE: This hole is not present in all tank 10 filter outlet pipes and, if present, it is difficult to locate with the pipe in situ, so pipe removal is imperative.

(d) If the hole is present, blank it off, using suitable material and a worm-drive hose clip.

(e) Refit the filter outlet pipe.

C. Test

(1) Operate the test rig and fill the system with fuel. Bleed off air by allowing fuel leakage at convenient nozzle blanks. Tighten the blanks.

(2) Increase the pressure to 25 psig (1.72 bar) and check that all joints and pipes are free from leakage.

(3) Release the pressure and disconnect the test rig.

(4) Remove the pipe blanks and fit the de-aeration nozzles.

(5) Carefully examine all the holes in each nozzle and ensure that they are free from blockage.

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D. Conclusion

(1) Remove the blank and worm drive hose clip from the base of the filter and reconnect the washing flow outlet pipe (Ref. 28-13-16, Removal/Installation).

(2) Remove the blank from the air bleed hole in the filter outlet pipe.

(3) Remove the pump test element and install the pump element (Ref. 28-13-11).

R (4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Check for freedom from corrosion the wing and access panels to be refitted. Fit the panels.

R (5) Remove the placard from the fuel management panel.

R (6) Refuel the tank (Ref. 12-11-28).

R (7) Check that there is no external leakage from the tank access panels.

8. Functional Test - Tank 10

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and adapter	E925103000
Combined fuel pressure and flow test rig, capable of delivering 20 gal/min (91 l/min) at a pressure of 25 psig (1.72 bar)	-

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B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check, by reference to the fuel quantity indicator, that the tank has at least 100 gal (455 l) capacity, below high level, to receive the fuel required for the test.

(4) Remove the de-aeration pump element from its canister in the tank (Ref. 28-13-11).

(5) Fit the pump test element in place of the pump element and connect the test rig to the adapter.

C. Test

(1) Operate the test rig and supply fuel at 25 psig (1.72 bar) to the pump test element.

(2) Check that the fuel flow rate into the pump test element is 15.5(±0.5) gal/min (70.5(±2.3) l/min).

(3) At the fuel management panel (3CM), check that the de-aeration pump indicator displays ON, indicating that the pressure switch has operated.

D. Conclusion

(1) Release the pressure and disconnect the test rig.

(2) Remove the pump test element and install the pump element (Ref. 28-13-11).

(3) Remove the placard from the fuel management panel.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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9. Leakage Test - Tank 11

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and plug adapter	E925116001
Fuel pressure test rig, capable of producing a pressure of 0 to 25 psig (0 to 1.72 bar)	-
Standard AN blanks, for de-aeration nozzles and filter outlet	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Drain the tank (Ref. 28-25-00).

(3) Remove the forward pump element from its canister in the tank (Ref. 28-23-53).

(4) Fit the pump test element in place of the pump element and connect the test rig to the adapter.

(5) Remove the tank access panel (Ref. Fig.501) to obtain access to the de-aeration components and pipelines.

(6) Gain access to the tank (Ref. 28-10-00, Servicing) and proceed as follows:

(a) Remove the de-aeration nozzles from the pipelines and fit standard AN blanks in place of the nozzles.

(b) Disconnect the washing flow pipe at the base of the filter and fit a standard AN blank. (Ref. 28-13-16, Removal/Installation).

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C. Test

(1) Operate the test rig and fill the system with fuel. Bleed off air by allowing fuel leakage at convenient nozzle blanks. Tighten the blanks.

(2) Increase the pressure to 25 psig (1.72 bar) and check that all joints and pipes are free from leakage.

(3) Release the pressure and disconnect the test rig.

(4) Remove the pipe blanks and fit the de-aeration nozzles.

(5) Carefully examine all the holes in each nozzle and ensure that they are free from blockage.

D. Conclusion

(1) Remove the blank at the filter outlet. Reconnect the pipe to the base of the filter (Ref. 28-13-16, Removal/Installation).

(2) Remove the pump test element and install the pump element (Ref. 28-23-53).

R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Check for freedom from corrosion the access panel to be refitted. Fit the panel.

R (5) Remove the placard from the fuel management panel.

WARNING: ENSURE THAT EXISTING FUEL LOADING PERMITS REFUELLING OF TANK 11 WITHOUT AIRCRAFT OVERBALANCE OCCURRING.

R (6) Refuel the tank (Ref. 12-11-28).

R (7) Check that there is no external leakage from the tank.

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10. Functional Test - Tank 11

A. Equipment and Materials

DESCRIPTION	PART NO.
Pump test element and plug adapter	E925116001
Combined fuel pressure and flow test rig, capable of delivering 20 gal/min (91 l/min) at a pressure of 25 psig (1.72 bar)	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check, by reference to the fuel quantity indicator, that the tank has at least 100 gal (455 l) capacity, below high level, to receive the fuel required for the test.

(4) Remove the forward electric pump element from its canister in the tank (Ref. 28-23-53).

(5) Fit the pump test element in place of the pump element and connect the test rig to the adapter.

C. Test

(1) Operate the test rig and supply fuel at 25 psig (1.72 bar) to the pump test element.

(2) Check that the flow rate of fuel into the pump test element is 9.25(±0.5) gal/min (41(±2.3) l/min).

D. Conclusion

(1) Release the pressure and disconnect the test rig.

(2) Remove the pump test element and install the pump element (Ref. 28-23-53).

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(3) Remove the placard from the fuel management panel.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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R DE-AERATION SYSTEM - APPROVED REPAIRS

1. General

NOTE: When manufacturing new pipes, L.56 is an approved alternative for AG.3 material.

DE-AERATION PUMP - REMOVAL/INSTALLATION

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

R The de-aeration pump is mounted beneath the left-hand cell of
R tank 10. It consists of a pump element bolted to a mounting plate which incorporates spring-loaded flap valves in the inlet and outlet ports to allow removal of the pump element without defuelling the tank. The mounting plate is bolted to an
R outlet pipe in the fuel tank, and cannot be removed without
R defuelling and entering the tank.

R The pump element and mounting plate are dealt with separately
R in the following procedures.

2. Pump Element (Ref. Fig. 401)

A. Equipment and Materials

	DESCRIPTION	PART NO.
R	Circuit breaker safety clips	-
R R	Torque spanner, 23 to 25 lbf in (0.26 to 0.282 mdaN)	-
R R	Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
R R	Receptacle, 1 gal (4.5 l), for fuel drainage	-

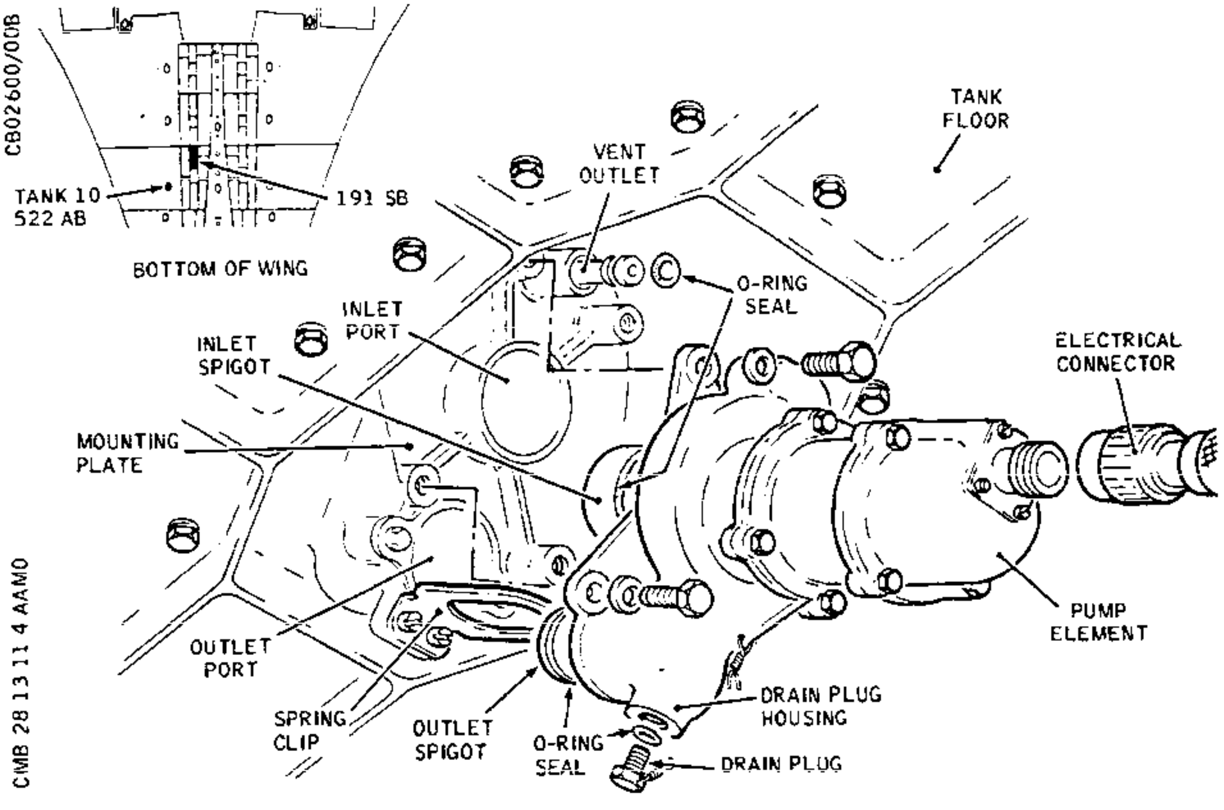
R B. Prepare to Remove Pump Element

(1) Trip the following circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R TANK 10 DE-AIR PUMP SUP	14-216	Q6666	F7
R TANK 10 DE-AIR PUMP IND	15-216	Q6667	E7

R (2) Remove access panel 191 SB in the bottom surface of
R the wing.

R (3) Position a suitable receptacle to collect any fuel drained from the pump element.



R - De-aeration Pump Element - Installation
Figure 401

R C. Remove Pump Element

R (1) Disconnect the electrical connector from the pump
R element.

(2) Remove the locking wire and slacken the drain plug sufficiently to facilitate subsequent removal.

(3) Remove the four bolts securing the pump element to the mounting plate.

(4) Slowly withdraw the pump element from the mounting plate until further movement is prevented by the drain plug housing when it reaches the end of the slot in the spring clip.

(5) Remove the drain plug and drain the fuel (approximately 2 pints (1 l) from the pump element.

<u>NOTE</u>: A continuous fuel flow, in excess of this amount, indicates that the inlet port flap valve is not closed, in which case the tank must be drained (Ref. 28-25-00, Servicing) and the inlet valve defect rectified.

(6) Deflect the spring clip to disengage it from the drain plug housing, and remove the pump element.

(7) Remove and discard the O-ring seals from the pump element inlet and outlet spigots and from the mounting plate vent outlet spigot.

(8) Loosely refit the drain plug to the pump element.

(9) Fit suitable blanks to the inlet, outlet and vent apertures in the mounting plate and the pump element.

D. Install Pump Element

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the mounting plate and the pump element.

(3) Check that the mating surfaces of the pump element and mounting plate inlet, outlet and vent connections are clean and undamaged, then fit new O-ring seals, lubricated in accordance with 20-23-11, to the pump element inlet and outlet spigots and the mounting plate vent outlet spigot.

(4) Support the pump element in position, inserting the inlet, outlet and vent spigots into their respective orifices. Deflect the spring clip and slide the pump element fully into position. Release the spring clip

and ensure that the drain plug housing is properly engaged in the spring clip slot.

(5) Renew the drain plug O-ring seal, lubricated in accordance with 20-23-11, and refit the plug to the pump element; torque-tighten the plug to between 23 and 25 lbf in (0.26 and 0.282 mdaN), and wire-lock it to the pump casing in accordance with 20-21-13.

(6) Secure the pump element to the mounting plate with four bolts and washers. Tighten the bolts, in diametrically opposite sequence, then torque-tighten them to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(7) Connect the electrical connector to the pump element, ensuring that the mating surfaces are clean and undamaged.

(8) Check that the electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers previously tripped.

(2) Carry out a Functional Test and a Leakage Test of the pump element (Ref. Adjustment/Test).

3. Mounting Plate (Ref. Fig. 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Receptacle, 1 gal (4.5 l), for fuel drainage	-

R After SB 28-018 For A/C 001-005,

DESCRIPTION	PART NO.
Sealant tools for removal/application of sealants, (Ref. 28-11-00, Approved Repairs - Sealants)	-
Sealants etc	-
PR1720R (Ref. 20-30-00, No.390)	-
PR1720SM (Ref. 20-30-00, No.351)	-
PR1720F (Ref. 20-30-00, No.352	-
Cyclohexanone, for use with sealant PR1720R	-
Cleaning Solvents	
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
Halogenated hydrocarbon solvent R.113 (Ref. 20-30-00, No.484)	-
RB Eurotwill cloth	-

B. Prepare to Remove Mounting Plate

(1) Defuel and drain tank 10 (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. para.2.) but, before withdrawing the pump from the mounting plate, position a suitable receptacle, remove the drain plug and allow the fuel to drain completely from both the element and the outlet pipe.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

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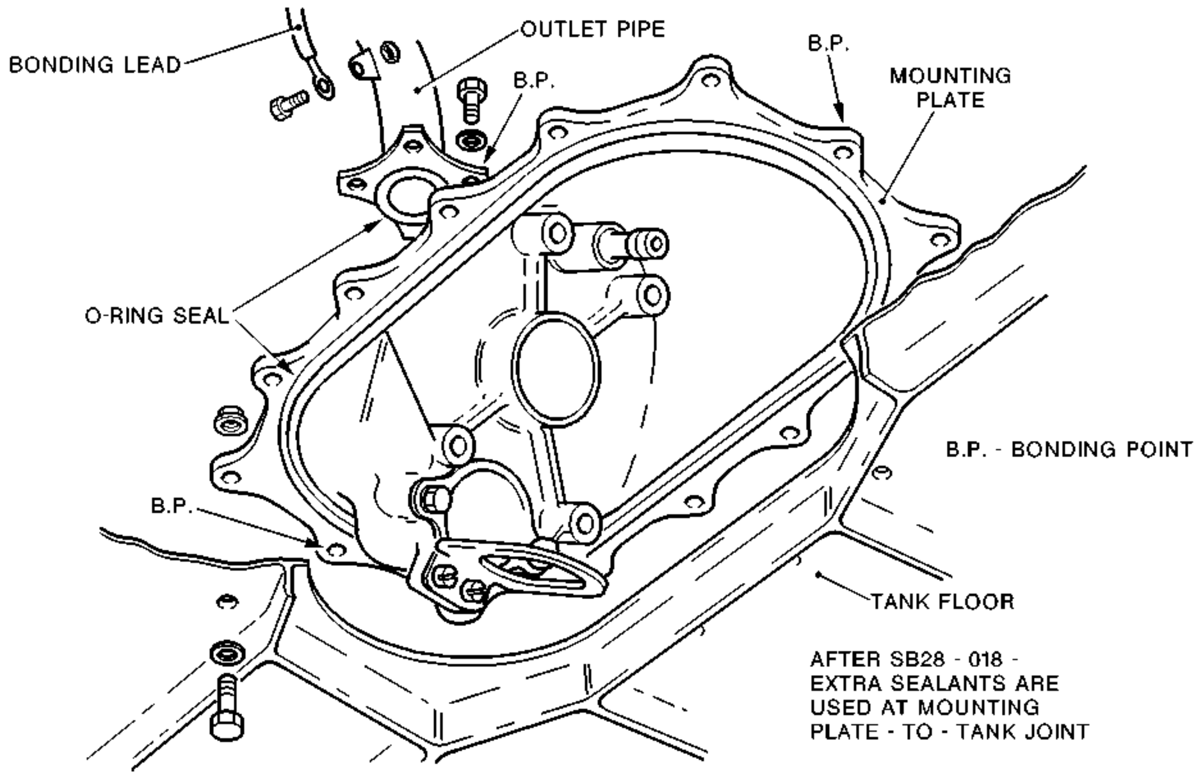

De-aeration Pump Mounting Plate - Installation
Figure 402

(3) Remove the tank access panel 522 AB (Ref. Fig. 401) and prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove Mounting Plate

Before SB 28-018

(1) Note the positions of the special bonding bolts during removal of the outlet pipe and mounting plate (Ref. Fig. 402).

(2) From inside the tank, remove the bolts and washers securing the outlet pipe to the mounting plate. Remove the bolts, washers and nuts securing the mounting plate to the tank. Remove the mounting plate.

(3) Remove and discard the O-ring seals from the outlet pipe and the mounting plate groove.

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(4) Fit suitable blanks to the outlet pipe and the mounting plate apertures.

After SB 28-018 For A/C 001-005

(1) Note the positions of the special bonding bolts during removal of the outlet pipe and mounting plate(Ref. Fig 402).

WARNING: SOLVENTS 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC. R.113 IS TOXIC.

TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS WHEN USING CLEANING SOLVENTS.

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(2) Remove the mounting plate as follows:

(a) From inside the tank, remove the bolts and washers securing the outlet pipe to the mounting plate.

(b) Using the sealant cutting tool and solvents, carefully remove the sealant from the mounting plate securing nuts.

(c) Remove the bolts, washers and nuts securing the mounting plate to the tank.

(d) Using the sealant cutting tool and solvents, carefully separate the mounting plate from the tank.

(e) Remove the mounting plate from the tank.

(4) Thoroughly clean off any remaining sealants and remove and discard the O-ring seals from the outlet pipe and the mounting plate groove.

(4) Fit suitable blanks to the outlet pipe and the mounting plate apertures.

D. Install Mounting Plate

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE ELECTRICAL BONDING OF THESE ITEMS IS IN ACCORDANCE WITH 20-27-11.

(1) Comply with the fuel and electrical safety precautions.

R (2) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

Before SB 28-018

R (3) Check that the mating surfaces of the mounting plate and the tank floor are clean and undamaged. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the mounting plate flange.

After SB 28-018 For A/C 001-005,

R (3) Apply sealant as follows:

(a) Fit a new, dry O-ring seal to the groove in the mounting plate flange.

(b) Ensure that the mating faces of the mounting plate and tank are clean and undamaged.

(c) Apply sealant PR1720R (prefabricated tape) or PR1720SM (semi-paste/fluid) to the flange on the mounting plate in accordance with 20-22-12.

(d) Position the mounting plate at the tank aperture.

R (4) Remove the blanks from the outlet pipe and the mounting plate apertures.

R (5) Check that the mating surfaces of the outlet pipe and the mounting plate are clean and undamaged, then fit a new O-ring seal, lubricated in accordance with 20-23-11, to the outlet pipe.

R (6) Secure the mounting plate to the tank floor with bolts, positioning the bonding bolts at the bonding points (Ref. Fig. 402). Tighten the bolts, in diametrically opposite sequence, then torque-tighten them to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

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R (7) Secure the outlet pipe to the mounting plate with the four bolts and washers, positioning the bonding bolt at the bonding point. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

After SB 28-018 For A/C 001-005,

R (8) Using sealant PR1720F (thick thixotropic paste), in accordance with 20-22-12, encapsulate the nuts of the mounting plate securing bolts. Allow the sealant to become tack-free, then apply an overcoating of sealant PR1720SM.

E. Conclusion

(1) Refit the tank access panel in accordance with 57-00-00, Removal/Installation.

(2) Carry out a Functional Test and a Leakage Test of the mounting plate (Ref. Adjustment/Test).

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DE-AERATION PUMP - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General

The pump unit is mounted beneath the left hand cell of tank 10. The unit consists of an element bolted to a mounting plate which incorporates spring loaded flap valves to allow removal of the element without defuelling the tank. The element is controlled by a switch on the fuel management panel and indication of the pump operating condition is given by an adjacent magnetic indicator.

2. Function Test - Pump Element (Ref. Fig. 501)

A. Prepare to Test

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power (Ref. 24-41-00).

(3) Remove the access panels.

B. Test

(1) On the fuel management panel set the DE-AIR switch to "ON" and check that:

(a) The pump operates.

(b) The magnetic indicator on the fuel management panel shows "ON" within three seconds of operating the switch.

(2) Set the switch to "OFF" and check that:

(a) The pump stops.

(b) The magnetic indicator shows "OFF" within three seconds of operating the switch.

3. Leak Test - Pump Element (Ref. Fig. 501)

A. Prepare to Test

(1) Refuel the tanks to full capacity (Ref. 12-11-28).

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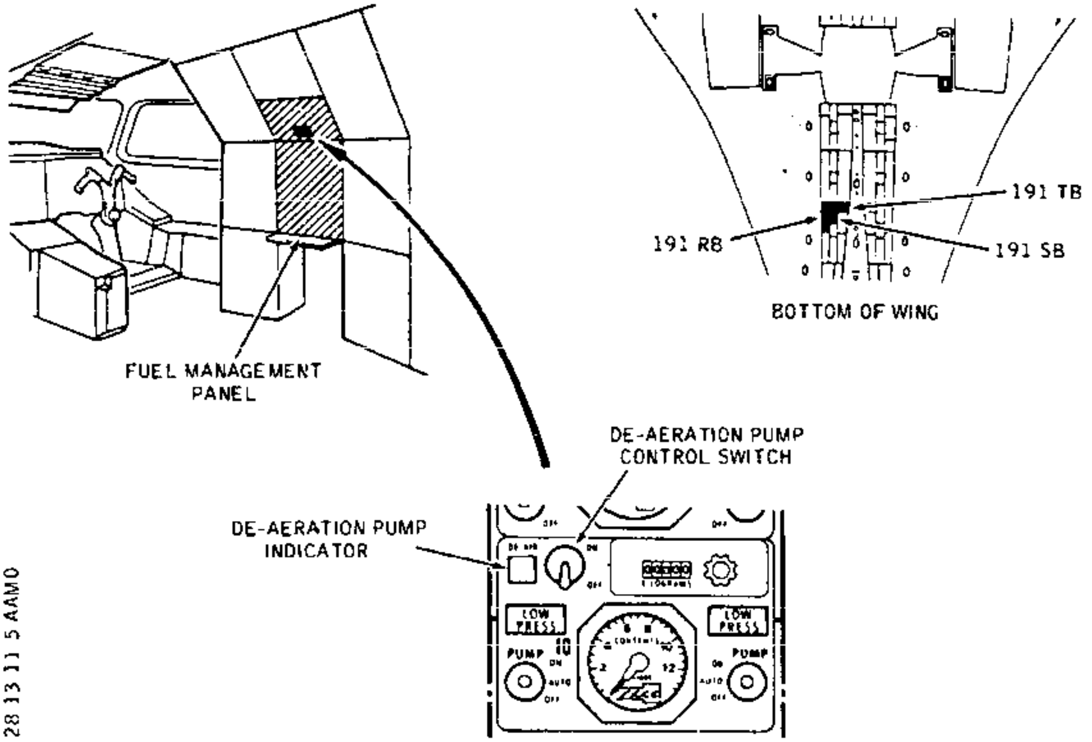

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- De-aeration Pump - Test Controls and Location
Figure 501

B. Test

(1) On the fuel management panel, set the DE-AIR switch to "ON".

(2) Check that there is no external leakage of fuel from the pump or pipe connections over a period of 15 minutes.

(3) On the fuel management panel, set the DE-AIR switch to "OFF".

C. Conclusion

(1) Refit the access panels.

(2) Switch off and disconnect electrical ground power (Ref. 24-41-00).

4. Function Test - Pump Mounting Plate

A. Prepare to Test

(1) Defuel the tank (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. 28-13-11, Removal/ Installation).

B. Test

(1) Manually push open the flap valves on the mounting plate inlet and outlet ports, and ensure that they reseat correctly under spring pressure.

(2) Refit the pump element (Ref. 28-13-11, Removal/ Installation).

5. Leak Test - Pump Mounting Plate

A. Test

(1) Remove the pump element (Ref. 28-13-11, Removal/ Installation).

(2) Refuel the tank to full capacity (Ref. 12-11-28).

(3) Check the rate of fuel leakage past the flap valves. This must not exceed 0.1 gal/hr (0.46 litre/hr).

B. Conclusion

(1) Refit the pump element (Ref. 28-13-11, Removal/ Installation).

DE-AERATION PUMP PRESSURE SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This pressure switch is mounted in the underwing fairing beneath the left-hand cell of tank 10 immediately forward of the de-aeration pump. Access is gained by removing an underwing panel.

2. Pressure Switch (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Torque spanner, 175 to 185 lbf in (1.977 to 2.09 mdaN)	-

B. Prepare

(1) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 10 DE-AIR PUMP SUP	14-216	Q6666	F7
TANK 10 DE-AIR PUMP IND	15-216	Q6667	E7
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22

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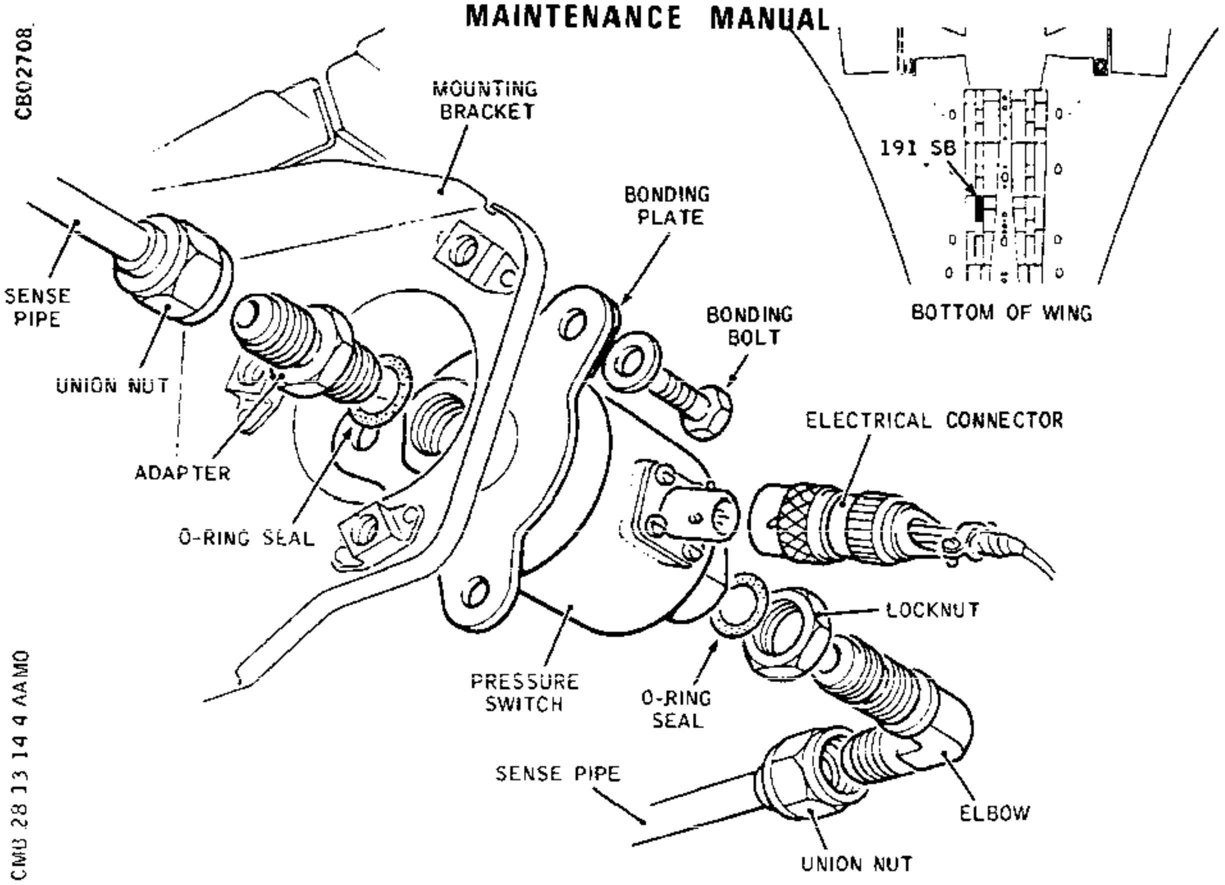

\- De-aeration Pump Pressure Switch - Installation

R Figure 401

(2) Defuel and drain tank 10 (Ref. 28-25-00, Servicing).

R (3) Remove access panel 191 SB.

C. Remove

(1) Disconnect the electrical connector from the switch.

(2) Disconnect the sense pipes from the switch and fit suitable blanks to the pipe unions.

(3) Remove the bolts securing the switch to the mounting bracket; remove the switch.

(4) Remove the adapter and O-ring seal from the mounting end of the switch. Discard the seal.

(5) Slacken the locknut and remove the elbow and O-ring seal from the other end of the switch. Discard the

seal. Fit suitable blanks to both ends of the switch.

D. Install

(1) Remove the blanks from the switch. Check that the mating surfaces of the switch and adapter are clean and undamaged.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, and refit the adapter to the mounting end of the switch. Torque-tighten the adapter to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(3) Check that the mating surfaces of the switch and elbow are clean and undamaged.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, and refit the elbow to the other end of the switch. Torque-tighten the elbow locknut to between 175 and 185 lbf in (1.977 and 2.09 mdaN).

(5) Ensure that the switch attachment lug which has the bonding plate is correctly positioned. Attach it with the bonding bolt, which has a dimpled head.

(6) Secure the switch to the bracket with the bolts and washers. Torque-tighten each bolt to between 25 and 30 lbf in (0.282 and 0.339 mdaN).

(7) Check that the electrical bonding is in accordance with 20-27-11.

(8) Remove the blanks from the sense pipe unions. Ensure that the mating surfaces of the adapters and pipe unions are clean and undamaged, then secure the sense pipes to the switch. Torque-tighten each union nut to between 175 and 185 lbf in (1.977 and 2.09 mdaN).

(9) Connect the electrical connector to the switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped in operation B.(1).

(2) Carry out a Functional Test of the switch (Ref. Adjustment/Test).

R (3) Refit the access panel 191 SB.

DE-AERATION PUMP PRESSURE SWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Fuel pressure output from the de-aeration pump, mounted below the left-hand cell of tank 10, is sensed by a pressure switch located immediately forward of the pump. The pressure switch controls a magnetic indicator close to the DE-AIR pump switch on the fuel management panel.

This topic comprises a Functional Test; Operational and System Tests are not applicable.

2. Functional Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Refuel tank 10 (Ref. 12-11-28) to high level capacity.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Remove access panels 191 RB, 191 SB and 191 TB.

B. Test

(1) On the fuel management panel, set the DE-AIR pump switch to "ON". Check that -

(a) the pump operates and

(b) the magnetic indicator on the fuel management panel displays ON within 3 s of the operation of the switch.

(2) Trip the TANK 10 DE-AIR PUMP SUP circuit breaker Q6666 on panel 14-216, map ref.F7, and check that the magnetic indicator displays OFF, resulting from pump output failure.

(3) Reset the circuit breaker tripped in operation (2)

and, with the pump operating, check the pressure switch and adjoining pipes for freedom from fuel leakage during a minimum period of 5 min.

(4) Set the pump switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Refit the access panels.

END OF THIS SECTION

NEXT

FILTERS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

One filter is installed in each of tanks 2, 5A, 7A, 8, 10 and 11 to protect the de-aeration nozzles from fuel-borne debris. The removal and installation procedures for the filters in tanks 2 and 8 are detailed in 28-22-12, Removal/Installation. The filters in tanks 10 and 11 are identical, each comprising a filter body which contains a filter element. The body consists of upper and lower halves, bolted together, which must be separated in order to remove the element.

The filters in tanks 5A and 7A are identical and their installation is similar. Each filter comprises a filter body which contains a filter element in a housing. The housing must be removed in order to remove the element.

This topic comprises instructions, under separate headings, for the removal and installation of a filter element and a filter in tanks 10, 11, 5A or 7A.

2. Filter Element - Tank 10 (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 31 to 40 lbf in (0.35 to 0.452 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.69 to 2.82 mdaN)	-

B. Prepare to Remove Filter Element

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

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(3) Remove the tank access panel 522 AB and prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove Filter Element

(1) Enter the tank and disconnect the bonding lead from the washing flow outlet pipe.

(2) Disconnect the union nut from the union adapter at the base of the filter.

(3) Remove the washing flow outlet pipe sufficiently to allow removal of the lower half of the filter body.

(4) Remove the bolts and washers securing the two halves of the filter together. Remove the lower half of the body and the filter.

(5) Remove and discard the O-ring seal.

(6) Fit suitable blanks to the upper half of the filter and the washing flow outlet pipe.

D. Install Filter Element

(1) Comply with the fuel and electrical safety precautions taken prior to removal.

(2) Remove the blanks from the upper half of the filter and the washing flow outlet pipe.

(3) Ensure that the two halves of the filter body and the filter element are clean and undamaged.

(4) Position a new O-ring seal, lubricated in accordance with 20-23-11, on the lower half of the filter body.

(5) Locate the filter element and the lower half of the filter body in the upper half of the body. Secure the two halves of the body together with washers and bolts. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit the union nut to the union adapter at the base of the filter and torque-tighten it to between 150 and 250 lbf in (1.69 and 2.82 mdaN).

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(7) With the bolt and nut, connect the electrical bonding lead to the clip on the washing flow outlet pipe. Torque-tighten the nut to between 31 and 40 lbf in (0.35 and 0.452 mdaN).

(8) Check that the electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

3. Filter - Tank 10 (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 31 to 40 lbf in (0.35 to 0.452 mdaN)	-
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.69 to 2.82 mdaN)	-
Torque spanner, 200 to 350 lbf in (2.26 to 3.95 mdaN)	-
Torque spanner, 307 to 317 lbf in (3.469 to 3.582 mdaN)	

B. Prepare to Remove Filter

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(3) Remove the tank access panel 522 AB and prepare the tank for entry (Ref. 28-10-00, Servicing).

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C. Remove Filter

(1) Note the positions of all special bonding bolts during removal. These bolts have a dimpled head.

(2) Enter the tank and remove the four bolts and washers securing the supply pipe to the filter inlet.

(3) Disconnect the two union nuts attaching the LH and RH system pipes to the elbow outlet pipe.

(4) Disconnect the bonding lead from the washing flow outlet pipe.

(5) Disconnect the union nut from the union adapter at the base of the filter.

(6) Remove the washing flow outlet pipe sufficiently to allow removal of the filter.

(7) Support the filter and remove the two attachment bolts and washers which secure it to the mounting bracket.

(8) Remove the filter and elbow outlet pipe.

(9) Remove the four bolts and washers securing the elbow outlet pipe to the filter.

(10) Remove and discard all O-ring seals.

(11) If a replacement filter is to be fitted, remove and retain the union adapter from the base of the filter. Remove and discard the O-ring seal.

(12) Fit suitable blanks to each of the open pipe ends and filter apertures.

D. Install Filter

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE ELECTRICAL BONDING REQUIREMENTS OF THESE ITEMS ARE SATISFIED IN ACCORDANCE WITH 20-27-11.

(1) Comply with the fuel and electrical safety precautions taken prior to removal.

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(2) If a replacement filter is being installed, remove the blank from the washing flow outlet. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the union adapter and fit the adapter to the washing flow outlet. Torque-tighten it to between 307 and 317 lbf in (3.469 and 3.582 mdaN).

(3) Remove the blanks from the open pipe ends and filter apertures.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the elbow outlet pipe and secure the pipe to the filter outlet with the bolts and washers. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

NOTE: An arrow on the filter body points in the direction of flow.

(5) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the supply pipe and to the outlets of the elbow pipes.

(6) Position the filter in the mounting bracket, inserting the supply pipe into the filter inlet. Secure the filter to the mounting bracket with the attachment bolts and washers. Torque-tighten each bolt to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(7) Secure the supply pipe to the filter with the bolts and washers. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(8) Fit the union nuts attaching the LH and RH system pipes to the elbow outlet pipe. Torque-tighten the union nuts to between 200 and 350 lbf in (2.26 and 3.95 mdaN).

(9) Fit the union nut securing the washing flow outlet pipe to the union adapter on the base of the filter. Torque-tighten the nut to between 150 and 250 lbf in (1.69 and 2.82 mdaN).

(10) With the bolt and nut, attach the electrical bonding lead to the clip on the washing flow outlet pipe. Torque-tighten the nut to between 31 and 40 lbf in (0.35 and 0.452 mdaN).

(11) Check that the electrical bonding is in accordance with 20-27-11.

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E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

4. Filter Element - Tank 11 (Ref. Fig.401 and 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.79 to 0.904 mdaN)	-
Viton sealant, for tank access panel	-

B. Prepare to Remove Filter Element

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(3) Remove the tank access panel 311 CB and prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove Filter Element

(1) Enter the tank and remove the bolts and washers securing the filter bracket to the frame. Disengage the bracket from the spigot. Remove and discard the rubber grommet.

(2) Remove the bolts and washers securing the two halves of the filter body together. Remove the lower half of the body and the filter element. Remove and discard the O-ring seal.

(3) Fit a suitable blank to the upper half of the filter body.

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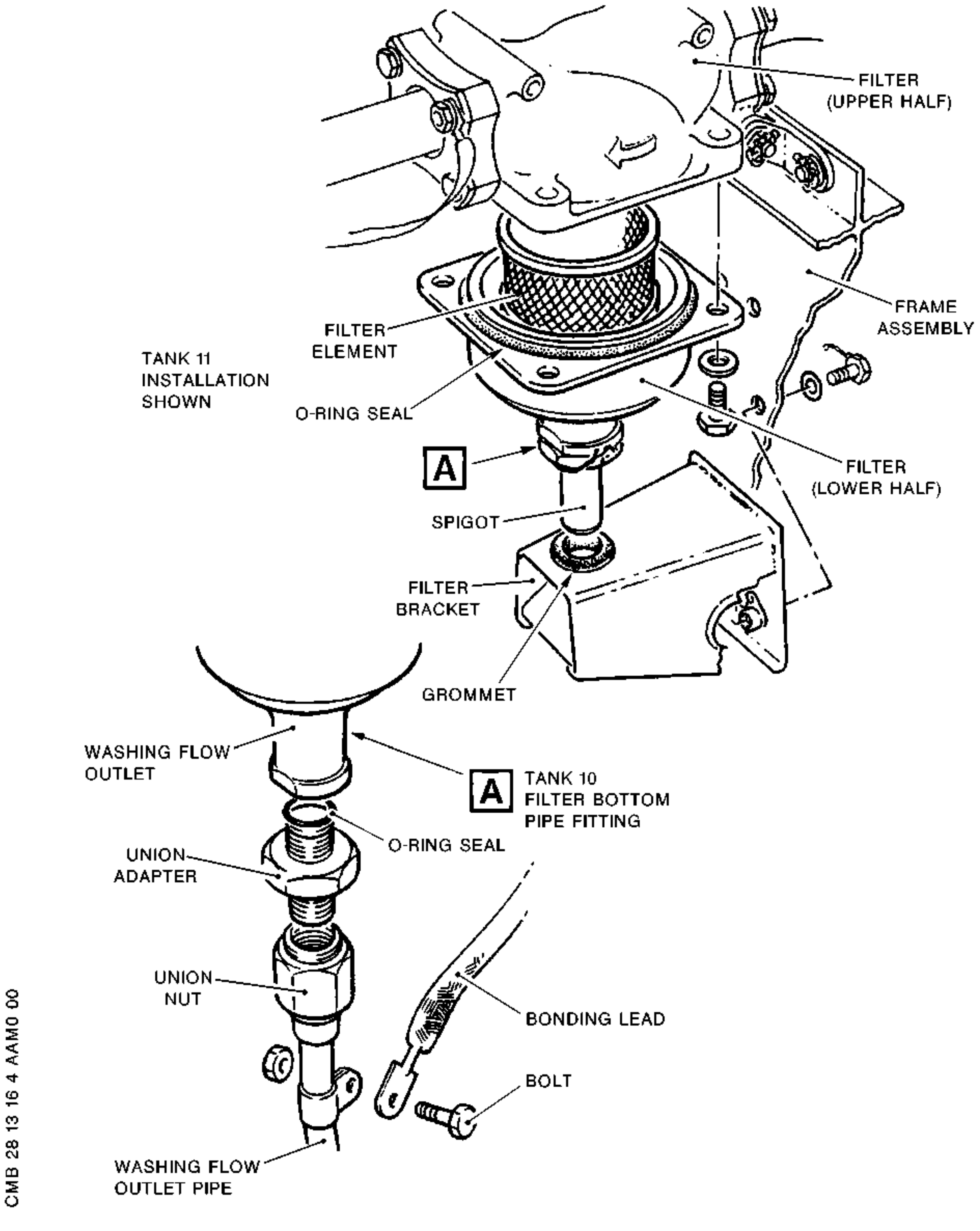
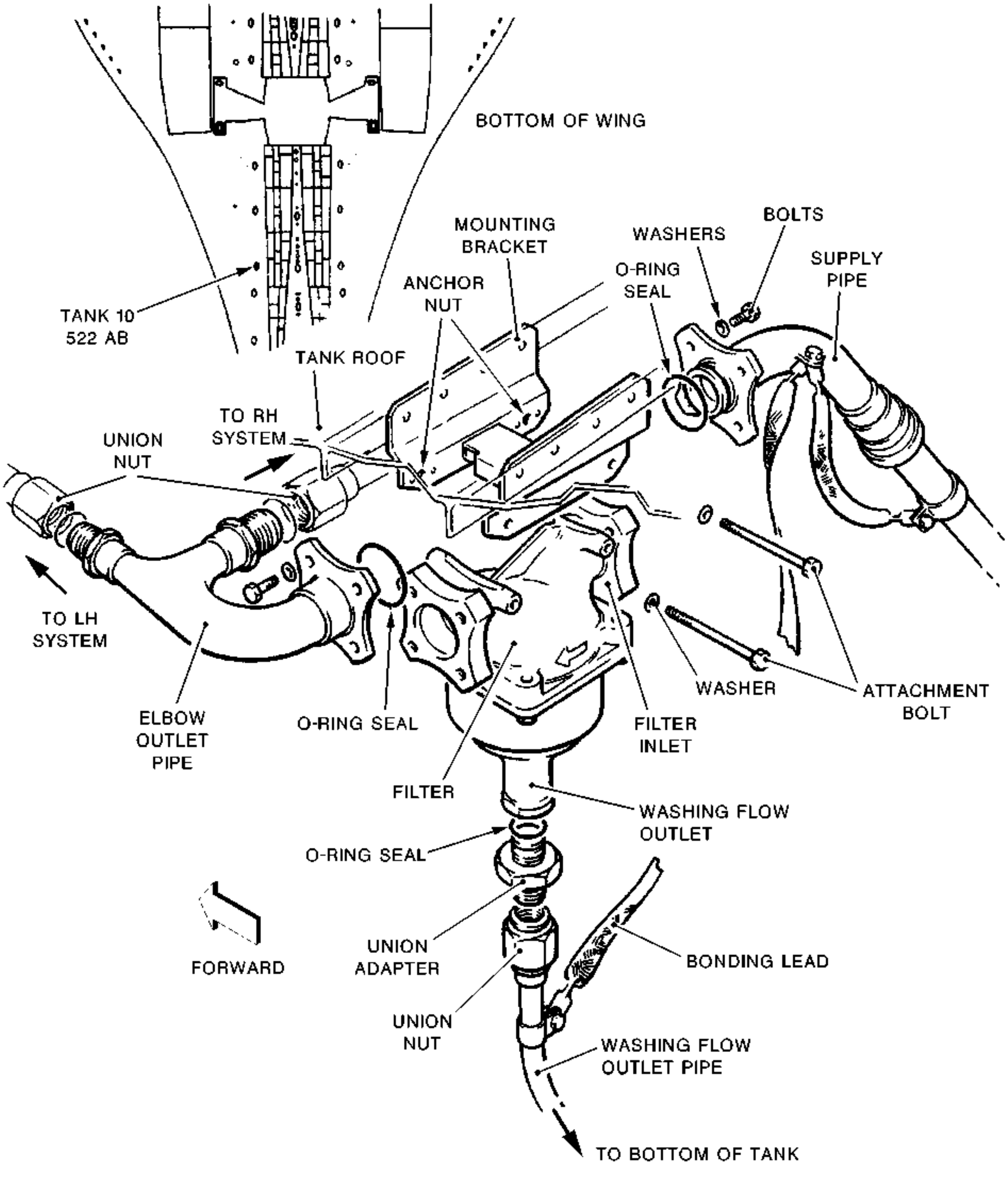


Filter Element, Tanks 10 and 11 - Installation
Figure 401



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Filter, Tank 10 - Installation
Figure 402

D. Install Filter Element

(1) Comply with the electrical and fuel safety precautions taken prior to removal.

(2) Remove the blank from the upper half of the filter body.

(3) Ensure that the two halves of the filter body and the filter element are clean and undamaged, and that the bore of the spigot is clear.

(4) Position a new O-ring seal, lubricated in accordance with 20-23-11, on the lower half of the filter body.

(5) Locate the filter element and the lower half of the filter body in the upper half of the body. Secure the two halves of the body together with washers and bolts. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit a new rubber grommet on the filter bracket. Engage the grommet with the spigot and align the holes in the bracket with those in the frame. Secure the bracket with washers and bolts. Torque-tighten each bolt to between 12 and 15 lbf in (0.136 and 0.169 mdaN). Wire-lock the bolt heads together in pairs in accordance with 20-21-13.

E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Visually inspect the access door and the door landing on the fuselage skin (Ref. Fig.403) and proceed as follows:

(a) Check that the contact surfaces on the door and landing are clean and free from paint.

(b) Ensure that the bush, at each attachment bolt position, is assembled in the landing.

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(c) Examine the seal for serviceability. If necessary, fit a new seal to the door.

NOTE: The nibs of the seal must contact the fuselage skin.

R (4) Fit the access door and wet-assemble the bolts with Viton sealant in accordance with 20-22-12. Torque-tighten each bolt to between 70 and 80 lbf in (0.79 and 0.904 mdaN). Ensure that the door is flush with the fuselage skin.

5. Filter - Tank 11 (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 20 to 25 lbf in (0.226 to 0.282 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 307 to 317 lbf in (3.469 to 3.582 mdaN)	-

B. Prepare to Remove Filter

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(3) Remove the tank access panel 311 CB and prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove Filter

(1) Note the positions of all special bonding bolts during removal. These bolts have a dimpled head.

(2) Enter the tank and remove the bolts and washers securing the elbow to the filter, and unscrew the nut from the adjoining pipe. Slide the pipe toward the electric pump as far as possible, then remove the elbow.

(3) Remove the bolts and washers securing the de-aeration fitting to the filter.

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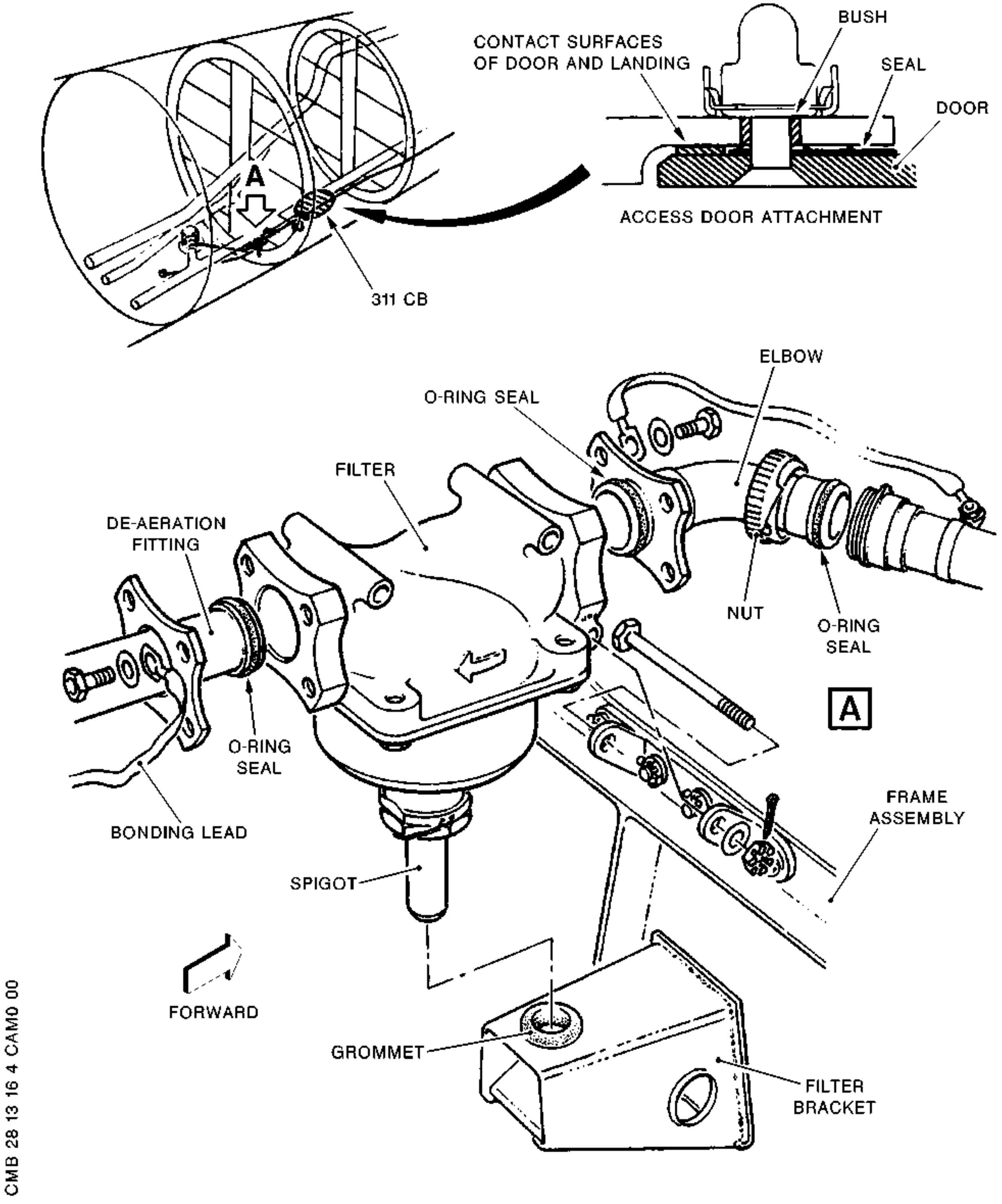

Filter, Tank 11 - Installation
Figure 403

(4) Remove the split pin, nut, washer and bolt securing the filter to the frame attachment bracket. Disengage the filter from the de-aeration fitting and the spigot from the filter bracket. Remove the filter.

(5) Remove and discard the O-ring seal from each end of the elbow and from the de-aeration fitting. Also remove and discard the rubber grommet from the filter bracket.

(6) Fit suitable blanks to each of the open pipe ends and the filter apertures.

(7) If the filter is to be renewed, remove the wire securing the spigot. Remove the spigot. Remove and discard the O-ring seal.

D. Install Filter

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE ELECTRICAL BONDING REQUIREMENTS OF THESE ITEMS ARE SATISFIED IN ACCORDANCE WITH 20-27-11.

(1) Comply with the electrical and the fuel safety precautions taken prior to removal.

(2) If a replacement filter is to be fitted, proceed as follows:

(a) Remove the blank cover from the spigot aperture in the filter unit.

(b) Check that the spigot is undamaged, and that its bore is clear.

(c) Position a new O-ring seal on the spigot and screw the spigot into the filter. Torque-tighten the spigot to between 307 and 317 lbf in (3.469 and 3.582 mdaN).

(d) Wire-lock the spigot to the filter unit in accordance with 20-21-13.

(3) Position a new rubber grommet in the filter bracket.

(4) Remove the blank covers from the filter de-aeration fitting and elbow. Position new O-ring seals, lubricated in accordance with 20-23-11, on each end of the elbow and on the end of the de-aeration fitting.

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(5) With the embossed arrow on the filter pointing rearward, engage the spigot with the grommet in the filter bracket and the filter with the de-aeration fitting and frame attachment bracket. Secure the filter to the bracket with the bolt, washer and nut. Torque-tighten the nut to between 20 and 25 lbf in (0.226 and 0.282 mdaN) and fit a split pin in accordance with 20-21-12.

(6) Secure the flange of the de-aeration fitting and the electrical bonding lead to the filter with the washers and bolts.

(7) Position the elbow and the bonding lead on the filter. Secure them with washers and bolts.

(8) Torque-tighten the bolts securing the elbow and the de-aeration fitting to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

(9) Secure the elbow to the pipe with the nut in accordance with 20-23-21.

E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. Adjustment/Test).

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Refit the tank access panel (Ref. para.4.).

6. Filter Element, Tank 5A or 7A (Ref. Fig.404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-

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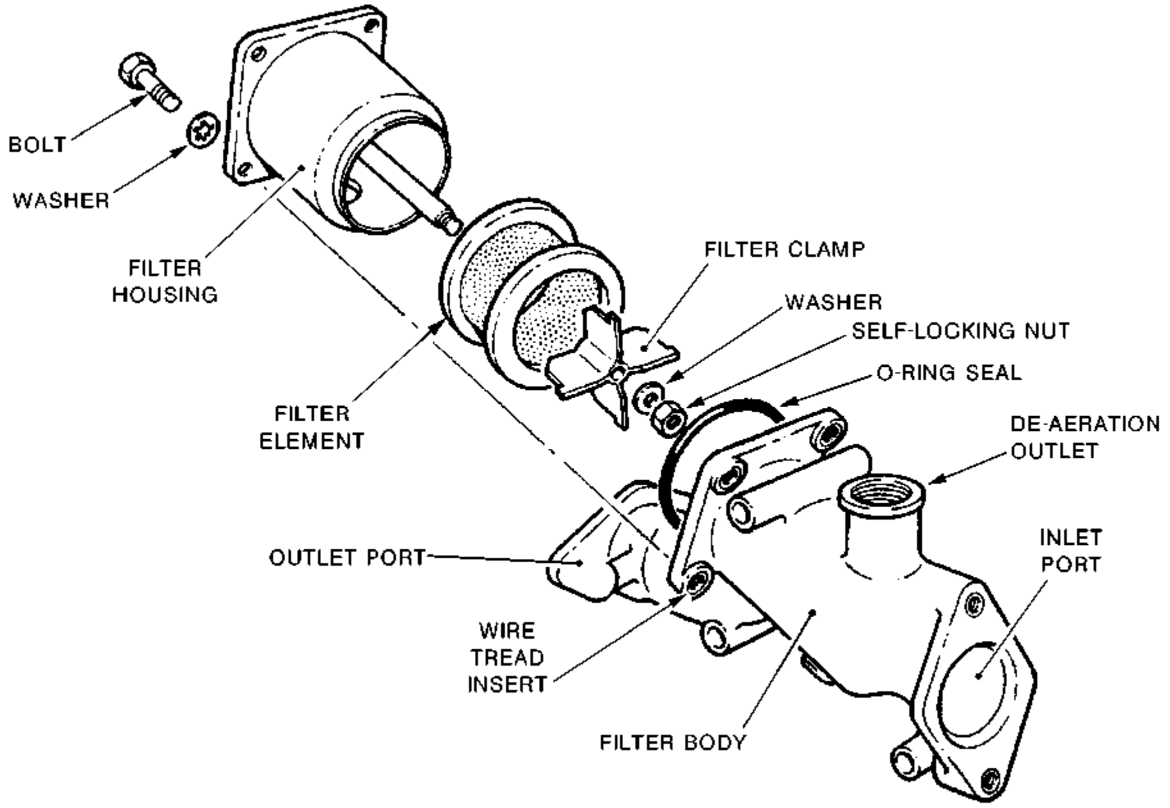

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Filter Element, Tanks 5A and 7A
Figure 404

B. Prepare to Remove Filter Element

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(3) Remove access panel 527 XT (tank 5A) or 627 XT (tank 7A), as appropriate, in the wing top surface to gain access to the filter, and also the adjacent panel 527 WT (tank 5A) or 627 WT (tank 7A), as appropriate, to enable the filter to be removed (Ref. Fig.405).

(4) Prepare the tank for partial entry (Ref. 28-10-00, Servicing).

C. Remove Filter Element

(1) Remove the four bolts and washers securing the filter housing to the filter body.

(2) Remove the filter housing and filter assembly from the body.

(3) Remove and discard the O-ring seal.

(4) Remove the self-locking nut, washer and filter clamp. Remove the filter element from the housing.

(5) Fit a suitable blank to the filter body.

D. Install Filter Element

(1) Comply with the fuel and electrical safety precautions taken prior to removal.

(2) Insert the filter element into the filter housing. Secure it with the filter clamp, washer and self-locking nut.

(3) Remove the blank from the filter body and ensure that the mating surfaces of the body and housing are clean and undamaged.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the filter body.

(5) Insert the filter housing into the filter body and secure it with washers and bolts. Torque-tighten each bolt to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

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7. Filter - Tank 5A or 7A (Ref. Fig.405)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 200 to 350 lbf in (2.26 to 3.95 mdaN)	-
Torque spanner, 445 to 455 lbf in (5.026 to 5.136 mdaN)	-

B. Prepare to Remove Filter

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(3) Remove access panel 527 XT (tank 5A) or 627 XT (tank 7A) in the wing top surface to gain access to the filter, and also access panels 527 QT and 527 GU (tank 5A) or 627 QT and 627 GU (tank 7A), as appropriate, to gain access to pipe clips downstream and upstream of the filter.

(4) Prepare the tank for partial entry (Ref. 28-10-00, Servicing).

C. Remove Filter

(1) Note the positions of all special bonding bolts during removal. These bolts have a dimpled head.

(2) Release the pipe clips downstream and upstream of the filter.

(3) Unscrew the de-aeration pipe union nut.

(4) Release the captive bolts securing the transfer pipes to each end of the filter.

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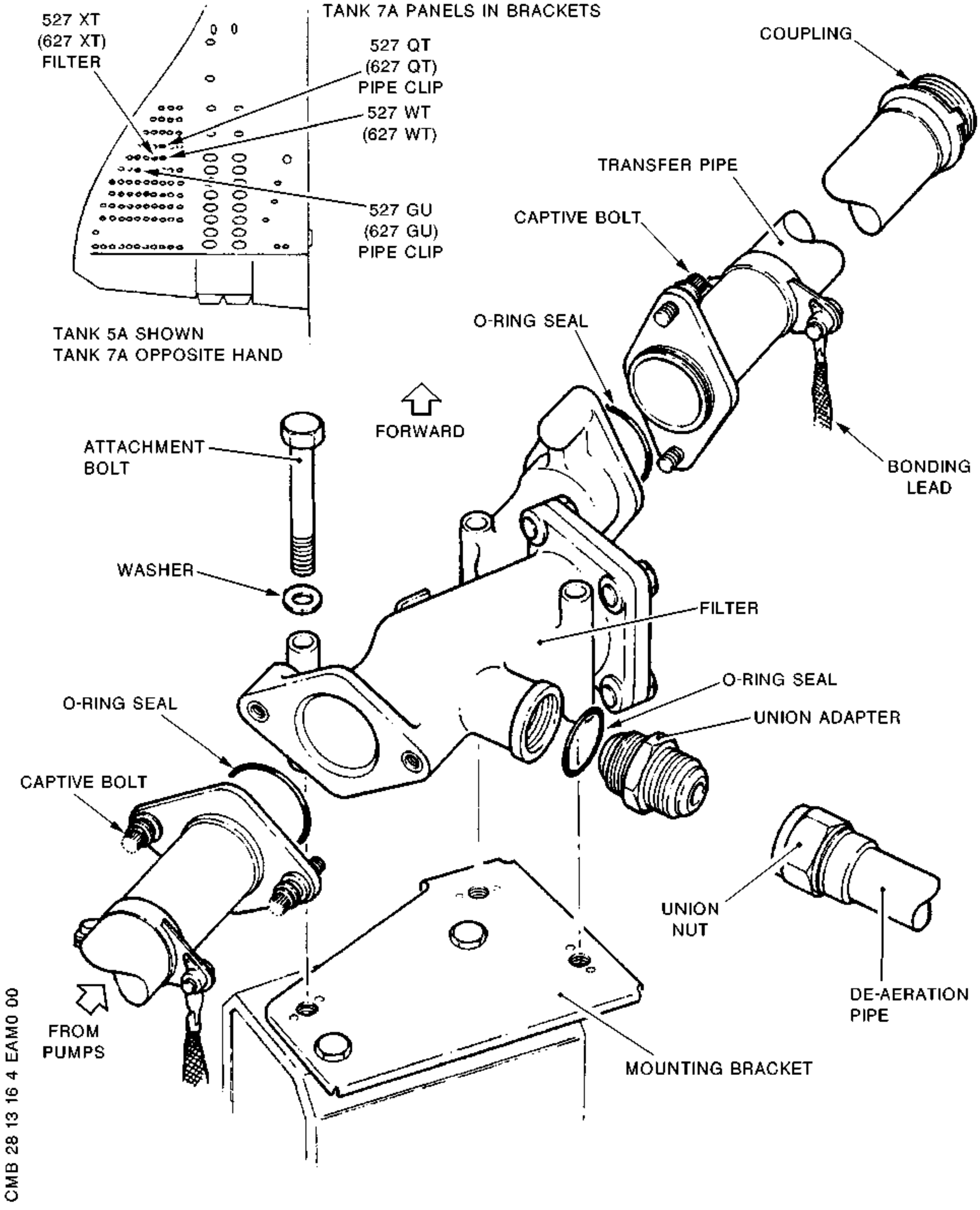

Filter, Tanks 5A and 7A - Installation
Figure 405

(5) Withdraw the transfer pipes from the filter body.

(6) Remove the three attachment bolts and washers securing the filter to the mounting bracket.

(7) Disengage the filter from the de-aeration and transfer pipes and withdraw it from the tank.

(8) Remove and discard the O-ring seals from the transfer pipe ends.

(9) If a replacement filter is to be installed, remove and retain the union adapter from the filter body. Remove and discard the O-ring seal.

(10) Fit suitable blanks to each of the open pipe ends and to the apertures in the filter.

D. Install Filter

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE ELECTRICAL BONDING REQUIREMENTS ARE SATISFIED IN ACCORDANCE WITH 20-27-11.

(1) Comply with the fuel and electrical safety precautions taken prior to removal.

(2) If a replacement filter is being installed, remove the blank from the de-aeration outlet. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the union adapter and fit the adapter to the de-aeration outlet. Torque-tighten it to between 445 and 455 lbf in (5.026 and 5.136 mdaN).

(3) Remove the blanks from the open pipe ends and filter apertures.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in each transfer pipe end.

(5) Position the filter on the mounting bracket and insert the transfer pipe ends into the filter body.

(6) Secure the filter to the mounting bracket with the three attachment bolts and washers. Torque-tighten each bolt to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(7) Secure the transfer pipes to the filter with the captive bolts. Torque-tighten each bolt to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

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(8) Fit the de-aeration pipe union nut to the union adapter on the filter body. Torque-tighten the nut to between 200 and 350 lbf in (2.26 and 3.95 mdaN).

(9) Secure the pipe clips downstream and upstream of the filter unit.

E. Conclusion

(1) Carry out a Leakage Test and a Functional Test of the tank de-aeration system (Ref. 28-13-00, Adjustment/Test).

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FILTERS - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

CAUTION: IF ANY SLIMY AND/OR DISCOLOURED DEPOSITS ARE ENCOUNTERED DURING INSPECTION, REFER TO 12-32-00, 'MICROBIAL CONTAMINATION OF FUEL TANKS', FOR FURTHER INFORMATION.

1. General

This topic covers the inspection of the de-aeration filter elements associated with tanks 5A, 7A, 6, 8 and 11. The filter elements for the tanks 6 and 8 systems are fitted within the valve bodies of transfer control valves associated with the main transfer system (Ref. 28-22-00), and the filter for the tank 6 system is located in tank 2.

2. Check

A. Prepare

(1) Defuel tanks 11, 5A, 7A, 2 and 8 (Ref. 28-25-00, Servicing), and prepare the tanks for entry (Ref. 28-10-00, Servicing).

(2) Ensure that all switches on the fuel management panel are at their normal ground positions (Ref. 28-00-00, Servicing), and that the refuel control panel access door is closed.

(3) Attach placards to the fuel management and refuel control panel door, warning that tests are being carried out and that the position of the switches must not be altered.

(4) Remove the filter element for the particular tank by reference to the appropriate procedure, as follows:-

(a) Tank 11: Removal/Installation - Filter Element, Tank 11.

(b) Tank 5A and 7A: Removal/Installation - Filter Element, Tank 5A or 7A.

(c) Tanks 2 and 8: 28-22-12, Removal/Installation - De-aeration Filter.

B. Check

(1) Check the filter for freedom from damage, corrosion, and foreign objects.

NOTE: The substance of foreign matter discovered (if any) must be determined so that any further rectification action, if required, can be decided.

(2) Clean the filter element (Ref. Cleaning/Painting).

C. Conclusion

(1) Refit the filter element by reference to the appropriate procedure, as follows:-

(a) Tank 11: Removal/Installation - Filter Element, Tank 11.

(b) Tanks 5A and 7A: Removal/Installation - Filter Element, Tank 5A or 7A.

(c) Tanks 2 and 8: 28-22-12, Removal/Installation - De-aeration Filter.

(2) Remove the warning placards from the fuel management and refuel control panels.

FILTERS - CLEANING/PAINTING

1. General

The stainless steel element of the filter may be cleaned, after removal of the element from the aircraft, for subsequent use provided the element is serviceable.

2. Filter Element

A. Materials and Equipment

DESCRIPTION	PART NO.
Clean fuel, or solvent BACM 302 (Ref. 20-30-00, No. 473)	-
Moisture-free compressed air (approx. 75 psi; 5.1 bars)	-
Bristle brush	-

B. Cleaning

(1) Thoroughly clean the element in clean fuel or solvent with a bristle brush. Extract debris, that is enmeshed in the element, by hand.

(2) Thoroughly dry the element in clean moisture-free compressed air.

(3) Visually inspect the filter element for cleanliness and damage; if serviceable place the element in an oil and moisture-proof bag.

ENGINE FEED SYSTEM - DESCRIPTION AND OPERATION

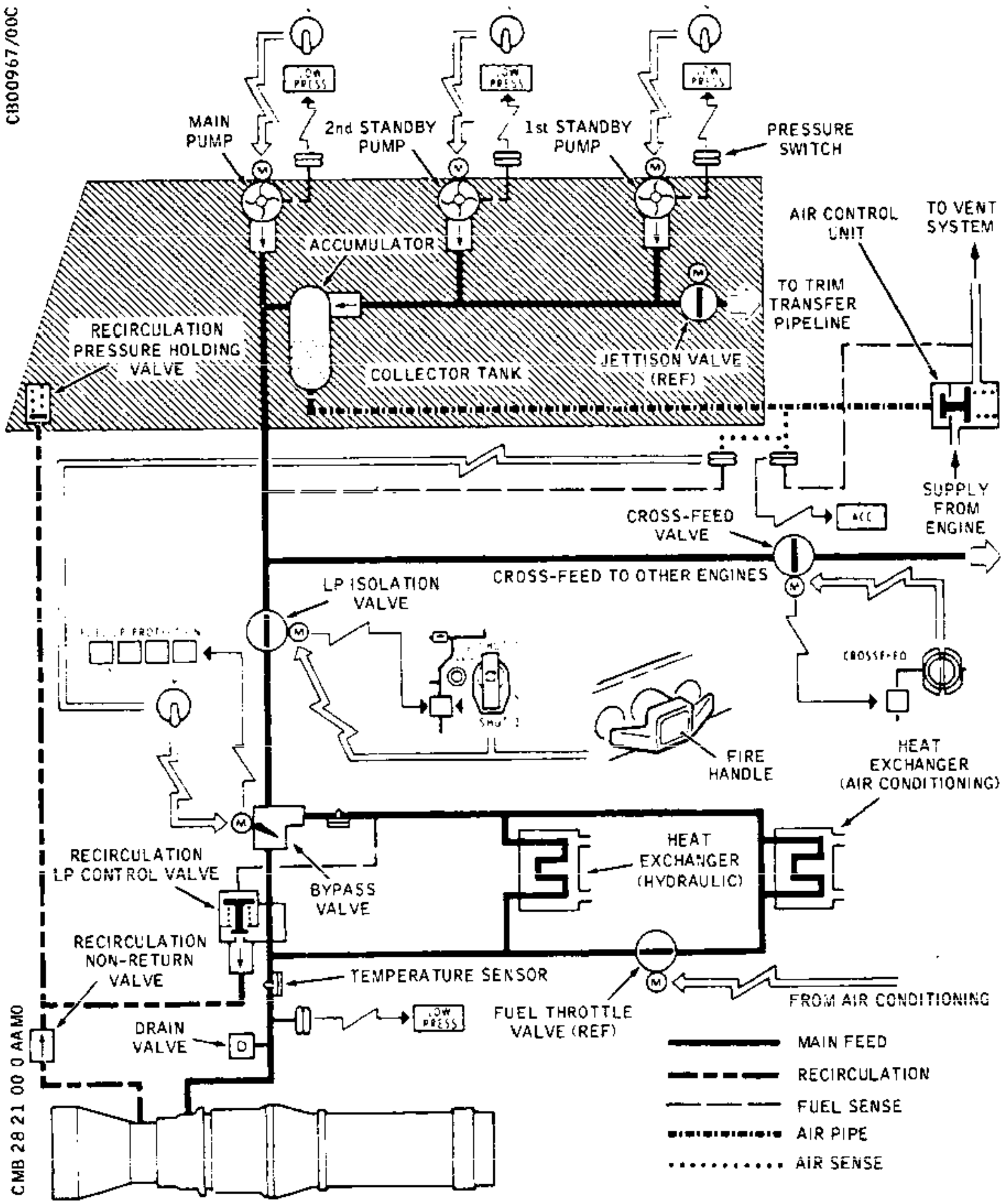
1. General (Ref. Fig. 001, 002 and 003)

There are four separate low-pressure engine feed systems all similar and self-contained; each one supplies an engine from a collector tank replenished, as the fuel is consumed, from the main transfer tanks (Ref. 28-22-00). A cross-feed pipe enables fuel to be supplied from any of the collector tanks to any or all engines. On its way to the engines the fuel also serves as a coolant through air-conditioning and hydraulic system heat exchangers.

Each of the four collector tanks, tanks 1, 2, 3 and 4, normally supplies fuel to its associated engine, engines 1, 2, 3 and 4 respectively. Each tank is equipped with a main feed pump, two standby pumps and a fuel accumulator. The pumps are electric motor-driven and separately controlled. The fuel accumulator is pressurized by engine air from a control unit and automatically takes over from the pumps during a short period of 'negative G' conditions. Pressure switches give warning of the fuel accumulators discharging, and of fuel low pressure at the pump outlets and engine inlets. The standby pumps are also used to discharge fuel through collector tank jettison valves into the trim transfer pipes during a fuel dump operation (Ref. 28-31-00).

From the collector tanks, the engine feed pipes take the fuel to the heat exchangers in the wing dry bays above the engines; the pipes from collector tanks 1 and 4 extend through the main tanks to the dry bays and pipes from tanks 2 and 3 pass directly to the dry bays. The main cross-feed pipe extends across the wing between tanks 6 and 7, passing through tanks 2 and 3 near their forward bulkheads. A small-bore cross-feed thermal relief pipe is connected to the main pipe in tanks 2 and 3 which allows a fuel bleed into tank 2 to prevent excessive fuel pressure due to thermal expansion.

Bypass valves ensure that an adequate flow of fuel is maintained through the heat exchangers when the engine demand is greater than the required heat exchanger flow. Any excess fuel is diverted by recirculation control valves into the recirculation pipes. These pipes commence at the engines and terminate at recirculation pressure holding valves in the collector tanks where the returned fuel is dispersed across the tank floor to ensure maximum cooling. A non-return valve in the pipe, at the nacelle to wing interface, prevents reverse flow in the event of a pipe failure. The bypass valves are normally operated by fuel pressure but are automatically biased fully open by electric motors when the fuel



R - Engine Feed Schematic (One Engine)
Figure 001

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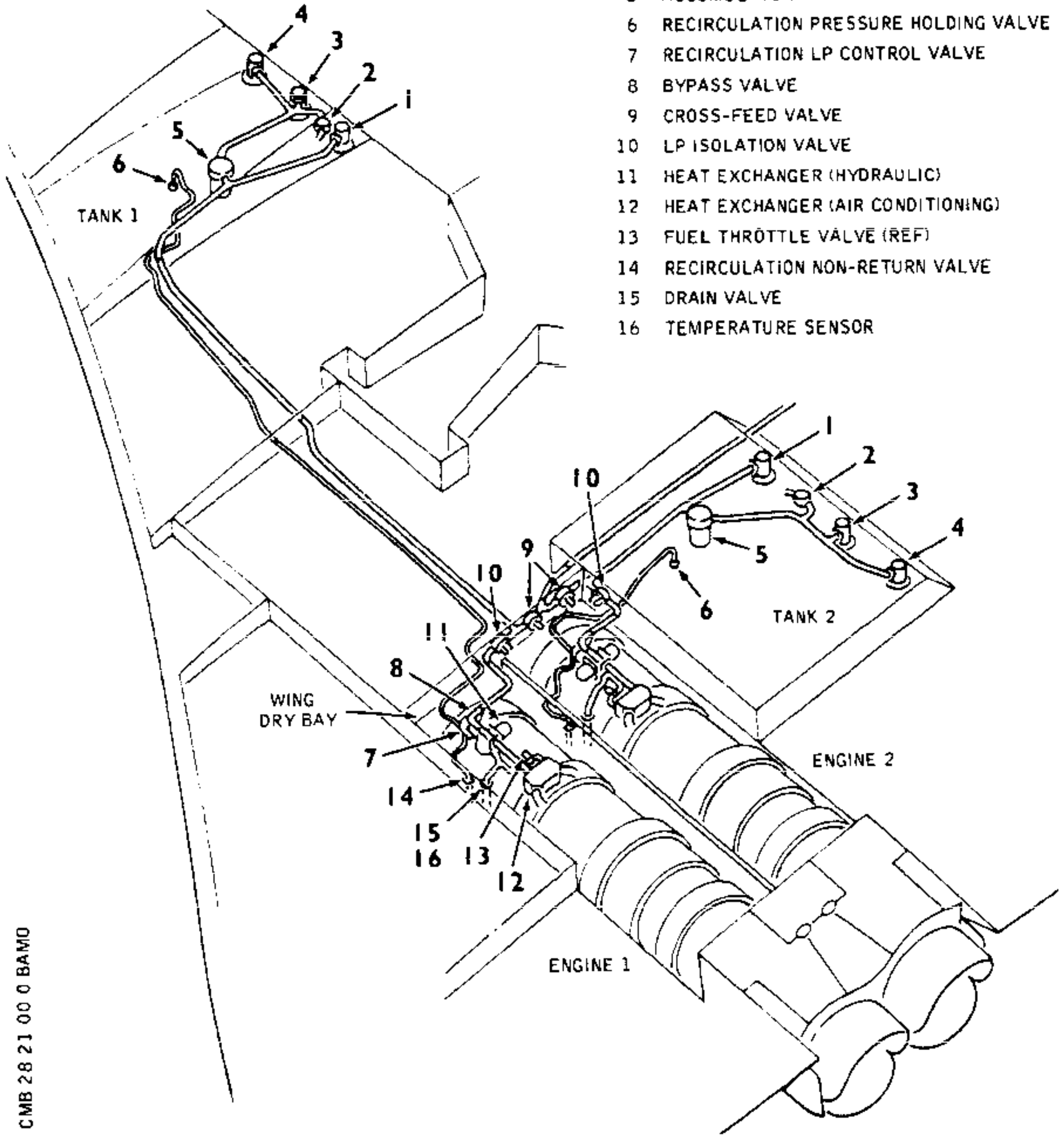
1 MAIN PUMP
2 JETTISON VALVE (REF)
3 2nd STANDBY PUMP
4 1st STANDBY PUMP
5 ACCUMULATOR
6 RECIRCULATION PRESSURE HOLDING VALVE
7 RECIRCULATION LP CONTROL VALVE
8 BYPASS VALVE
9 CROSS-FEED VALVE
10 LP ISOLATION VALVE
11 HEAT EXCHANGER (HYDRAULIC)
12 HEAT EXCHANGER (AIR CONDITIONING)
13 FUEL THROTTLE VALVE (REF)
14 RECIRCULATION NON-RETURN VALVE
15 DRAIN VALVE
16 TEMPERATURE SENSOR



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\- Engines 1 and 2 Feed Systems - Component Location
Figure 002

R

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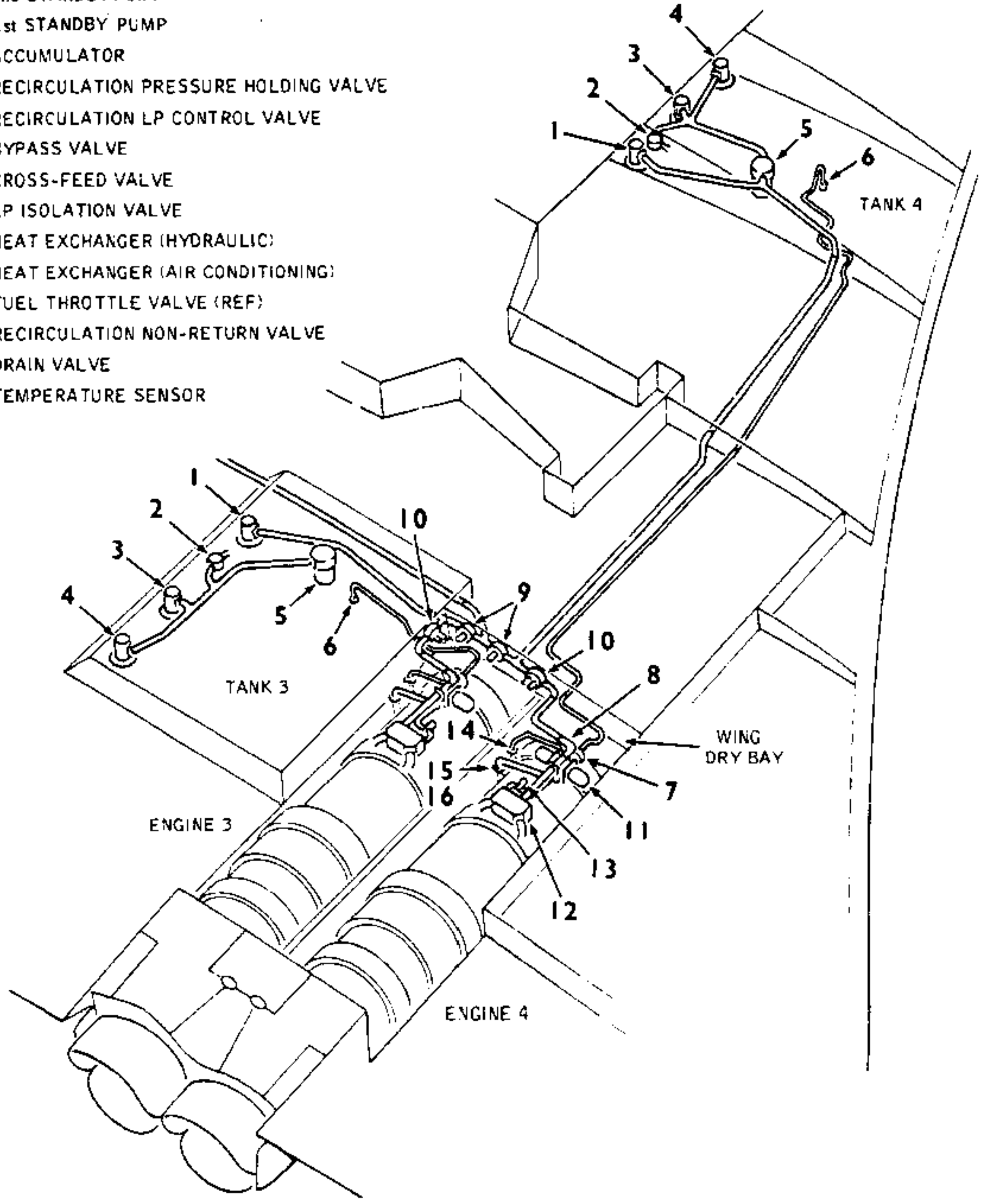
1 MAIN PUMP
2 JETTISON VALVE (REF)
3 2nd STANDBY PUMP
4 1st STANDBY PUMP
5 ACCUMULATOR
6 RECIRCULATION PRESSURE HOLDING VALVE
7 RECIRCULATION LP CONTROL VALVE
8 BYPASS VALVE
9 CROSS-FEED VALVE
10 LP ISOLATION VALVE
11 HEAT EXCHANGER (HYDRAULIC)
12 HEAT EXCHANGER (AIR CONDITIONING)
13 FUEL THROTTLE VALVE (REF)
14 RECIRCULATION NON-RETURN VALVE
15 DRAIN VALVE
16 TEMPERATURE SENSOR



\- Engines 3 and 4 Feed Systems - Component Location
Figure 003

R

accumulators discharge.

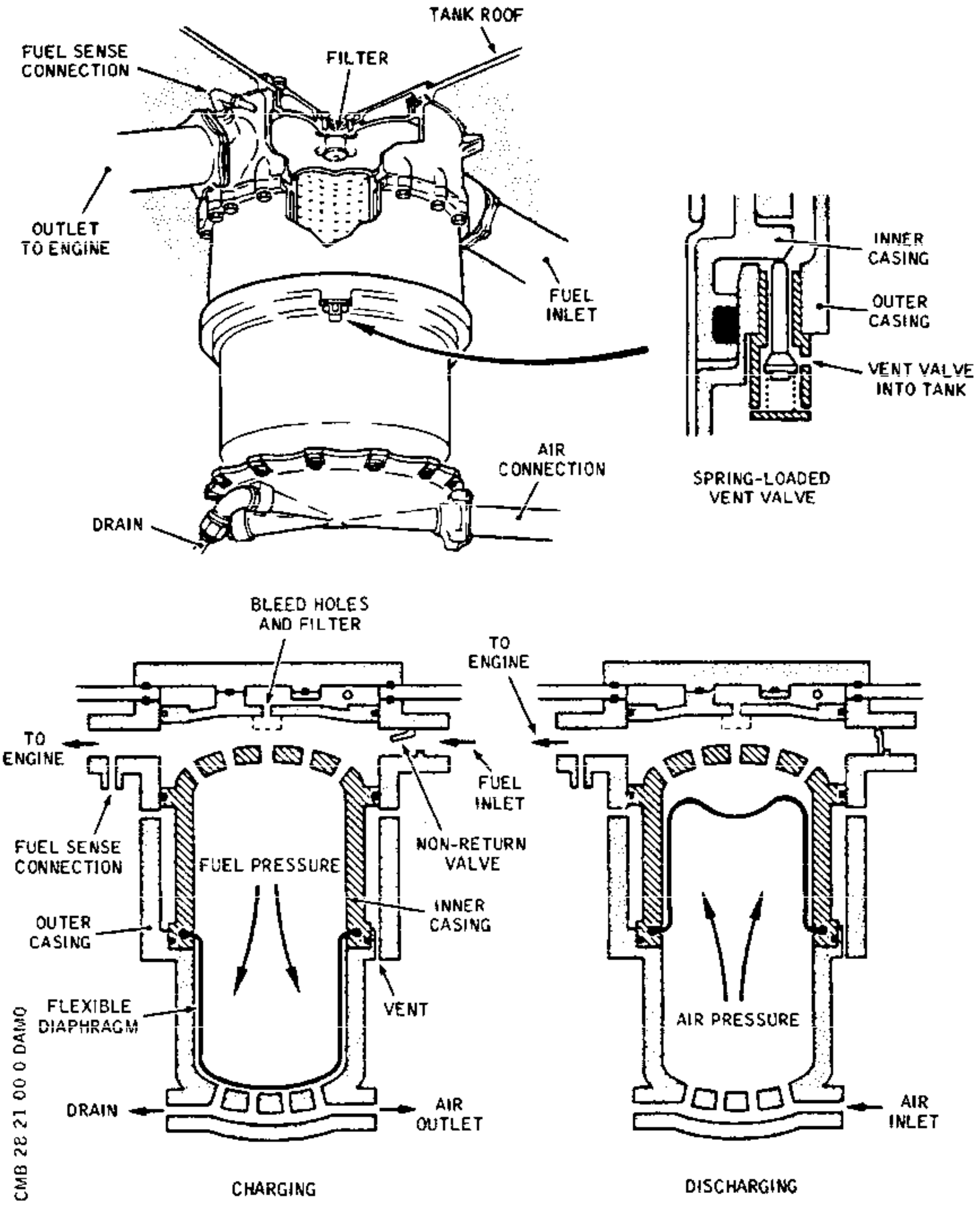
R Cross-feed valves control the interconnections between the
R four engine feed pipes and are located so that the heat
exchangers remain in the path of cross-fed engines. Fuel
from each collector tank is shut off from the engines and
the system components in the wing dry bays by low pressure
(LP) isolation valves. The jettison, cross-feed and LP
R isolation valves are electrically operated and, together with
R the feed pumps and pressure holding valves, can be isolated
R from the fuel in the tanks or pipelines, enabling a valve
R or pump to be removed without draining the associated tank.
R Drain valves are located in the feed pipes immediately before
R the pipes pass into the nacelles.

R The electrical supplies and control are arranged to obviate
the total loss of an engine feed system with a single
electrical failure. Each feed system has its own group of
control switches and indicators laid out in a fuel flow
R form on the fuel management panel at the third crew member's
station. Certain indications are supplemented by a FUEL
master warning displayed on the roof panel above the pilots'
R stations. The LP isolation valves may be singly controlled
R either by a switch on the fuel management panel or by
operating a fire handle on the roof panel.

2. Fuel Accumulator (Ref. Fig. 004)

The accumulator, which has a capacity of 5.25 gal (23.87 l), comprises a housing, fixed around an aperture in the tank roof, supporting an outer casing and base; an inner casing fits inside the outer casing. The tank aperture is closed by a double cover. All sealing on the assembly is by O-ring seals at the various joints.

The housing is attached to the tank structure at four
mounting lugs, and has fuel inlet and outlet connections,
with a flap non-return valve at the inlet connection, and
connections for a fuel pressure sensing pipe and a vent
pipe. The outer casing is attached to the housing by two
semicircular bolting clamps. The casing is a cylinder
with the lower end closed by a perforated dome, and a step,
halfway along the length of the casing, locates the inner
casing. Three spring-loaded poppet valves are fitted at
the step. These valves are normally held open by the
inner casing flange to allow fuel from the tank to
circulate in the annular space between the inner and outer
R casings to obviate static pockets of fuel. When the inner
casing is withdrawn, the valves close to reduce to a
minimum drainage of fuel from the tanks through the drain
in the accumulator base. Holes near the top of the outer



Fuel Accumulator
Figure 004

casing allow venting of the space between the casings.

The base is a dome-shaped casting, bolted to the lower end of the outer casing. The casting has three pipe connections, one for pressure air supply and two drains. Only one drain connection is used on each installation.

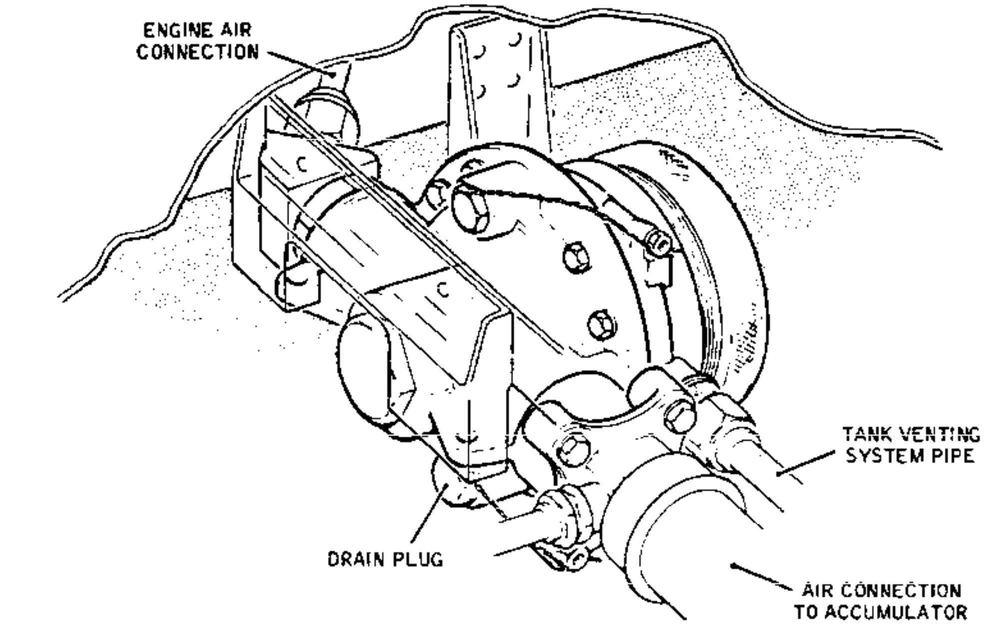
The inner casing is a cylinder, closed at the upper end by a perforated dome. A support flange is fitted at the upper end and the casing is secured to the housing by four ring segments with fixing holes elongated to allow the segments to be moved outward to engage a groove in the housing. The rim of the diaphragm is attached to a flange at the lower end of the inner casing by a bolted retaining ring.

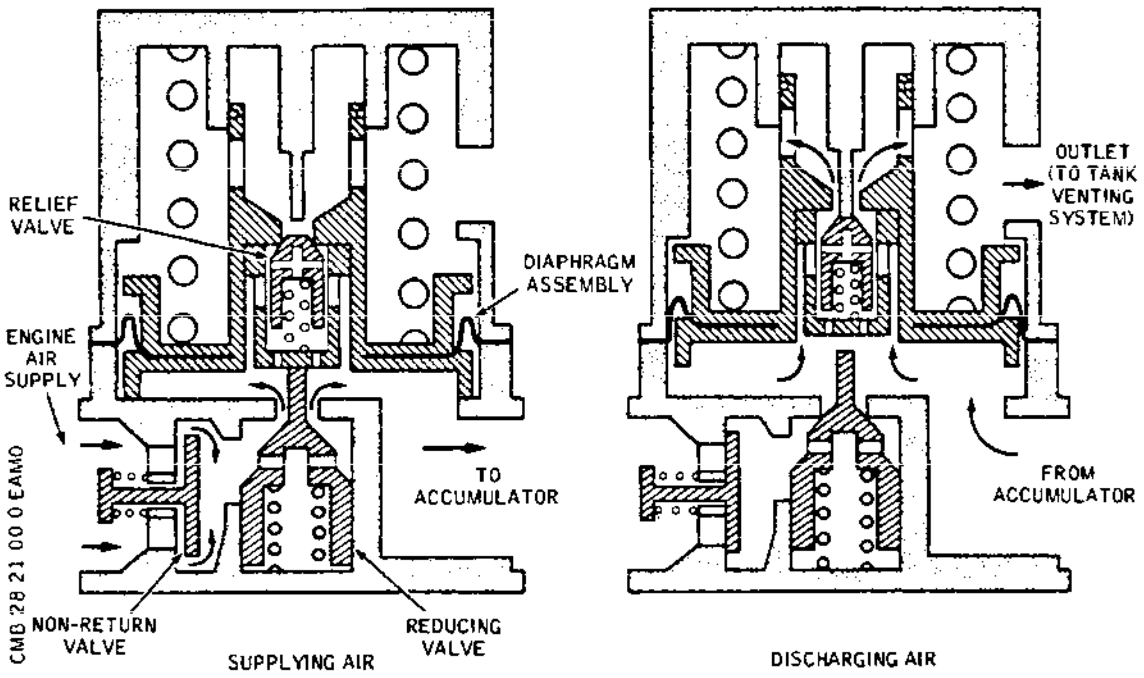
The tank aperture is closed by an inner and an outer cover. The inner cover is secured to the housing by four segments. Air bleed holes at the centre of the cover vent the housing to the space between the two covers and thence through a drain pipe back to the tank. The bleed hole is protected by a metal gauze filter. The circular outer cover is flush with the aircraft skin and is secured by captive screws. A secondary cover, at the centre of the outer cover, gives access to the air bleed holes in the inner cover.

When the aircraft is in flight, fuel pressure acts on the upper side of the diaphragm and air pressure from the associated air supply control unit acts on the underside of the diaphragm. During normal flight fuel pressure exceeds air pressure, the diaphragm is deflected downward and the accumulator is filled with fuel. If the fuel pressure falls below the air pressure, the diaphragm is deflected upward and fuel is discharged into the engine feed pipe. The non-return valve at the accumulator inlet prevents fuel from being discharged back into the supply pipe. The accumulator recharges when normal fuel pressure is restored; during recharging, air displaced from under the diaphragm is vented back through the air supply control unit. The operation of the accumulator is monitored by the accumulator pressure switch unit and indication is given by a caption light on the fuel management panel.

3. Air Supply Control Unit (Ref. Fig. 005)

Four of these units are fitted, in the wing bottom fairings, to control the supply of engine air, tapped from the hydraulic system (Ref. 29-00-00), to the fuel accumulators. Each unit comprises an air pressure reducing valve, a spring-loaded relief valve, a spring-loaded non-return valve, a stabilizing plate and a piston/rolling diaphragm





Air Supply Control Unit
Figure 005

assembly, all contained within upper and lower bodies.

R The upper body incorporates the inlet connection, from the engine, and the outlet connection, to the accumulator, and houses the non-return valve and the reducing valve. The upper body flange is bolted to the flange on the lower body, with the stabilizing plate and rolling diaphragm secured between the flanges.

The lower body incorporates the connection to the vent system and provides the housing for the piston/diaphragm assembly.

Plugs fitted in both upper and lower bodies allow fuel, which may have collected on either side of the diaphragm, to be drained.

When there is no air supply, the non-return valve is held closed by its spring, the piston is held against the stabilizing plate by the main spring, the reducing valve is held away from its seat by the relief valve housing and the relief valve is held closed by its spring. When air is fed to the unit, air entering the inlet port lifts the non-return valve from its seat and passes to the outlet via the reducing valve. From the outlet, the air passes to the fuel accumulator.

R The pressure of the air on the piston and diaphragm compresses the main spring until, at the preset outlet pressure, the reducing valve closes. A fall in outlet pressure, when the accumulator discharges fuel, reduces the load on the piston and causes the main spring to move the piston assembly to open the reducing valve so that more inlet air is admitted and outlet pressure restored.

When the accumulator diaphragm returns to its normal position after discharge, and fuel pump pressure is restored, the outlet air pressure rises above the pre-set value and the excess pressure moves the piston against the main spring, but the relief valve movement is stopped by the adjuster which opens the relief valve and allows the excess pressure to escape to the vent system through the lower body. When the outlet pressure returns to normal, the main spring has moved the piston away from the relief valve adjuster so that the relief valve closes and stops the venting.

4. Heat Exchanger Assemblies

The air conditioning system heat exchanger and the fuel throttle valve are described in Chapter 21, and the

hydraulic system heat exchanger in Chapter 29.

5. Pump Unit (Ref. Fig. 006)

Each collector tank contains one main and two standby pump units. All are similar, each comprising an electric motor-driven, low pressure centrifugal pump element, projecting from below up into a canister bolted to the floor of the tank. The canister isolates the pump from the fuel in the tank, enabling removal of the pump element without draining the tank. Access to the pumps is gained through panels in the wing bottom surface.

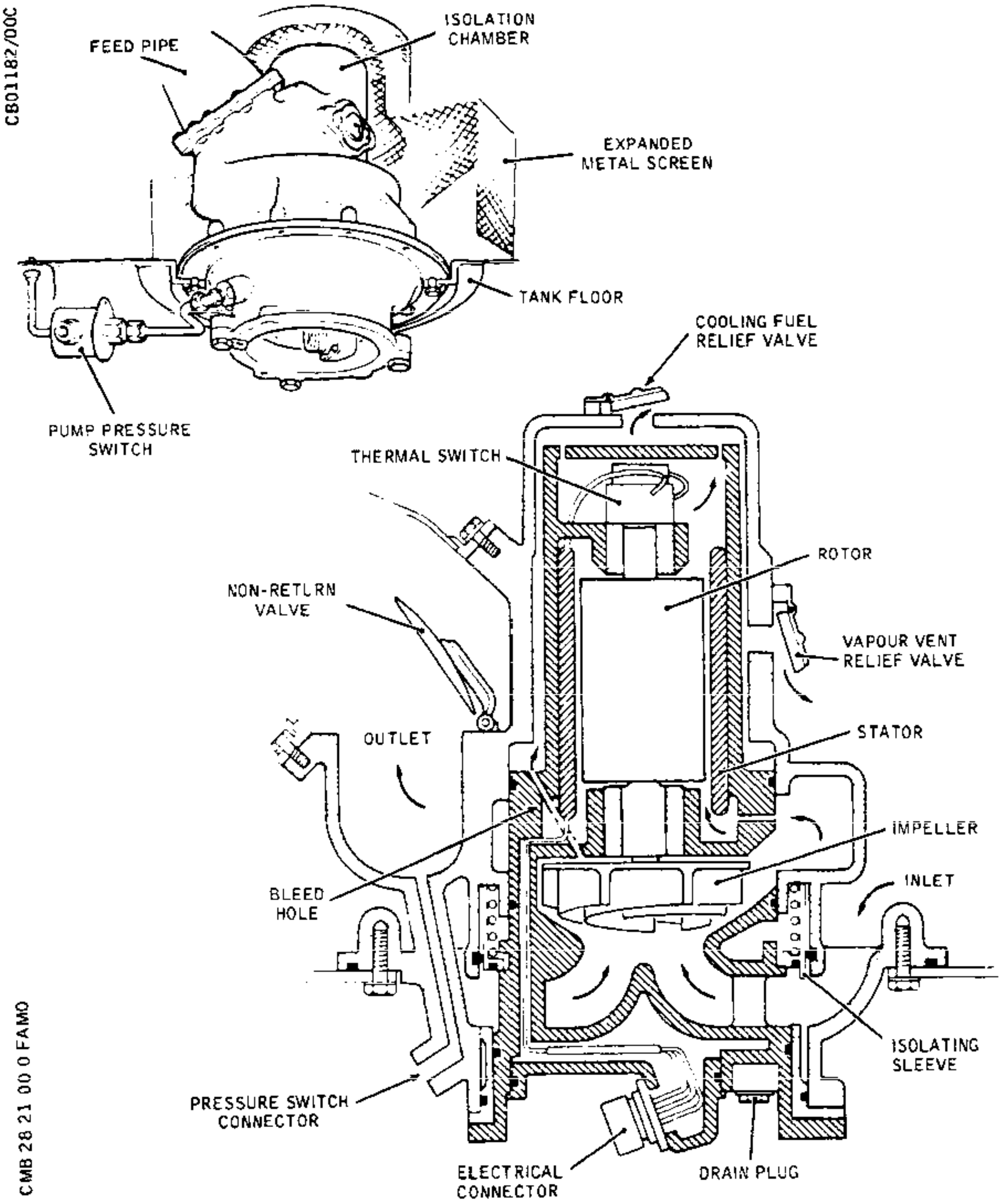
Fuel enters the canister through an expanded metal screen to protect the pump from the ingress of foreign material. Some of the fuel being pumped is circulated through the pump casing and bearings to serve as a coolant and lubricant for the motor. A bleed hole in the pump impeller compartment allows fuel vapour to escape and merge with circulated fuel from the pump casing into the upper portion of the canister from where it is vented through two flap valves into the tanks. One of the valves vents the cooling flow and the other is for vapour release.

The electrical supply to each pump is taken from a 200/115 V, three-phase a.c. busbar and is switched by a control relay which is directly controlled by a two-position switch on the fuel management panel. If the motor operates for a period under dry conditions, a thermal switch will protect the motor from overheating by switching it off, or on, within a pre-set temperature range. If the motor temperature exceeds the maximum setting of the thermal switch, thermal fuses, one in each phase of the motor windings, will rupture and make the pump inoperative.

Fuel from the tank enters at the base of the canister through an annular port. When the pump is withdrawn from the canister, a spring moves a fuel-tight sleeve downward to close the canister port and shut off the fuel from the tank. A drain plug is provided at the base of the pump for emptying fuel from the canister and pump prior to pump removal. The pump discharges into an outlet annulus formed in the canister walls from where the fuel passes through a non-return flap valve into the supply pipe. The non-return valve prevents reverse flow.

6. Fuel Temperature Sensor

Temperature probes measure the fuel temperature upstream and downstream of the heat exchangers (Ref. 28-45-00). The temperature sensors are mounted, and secured by a nut, in



R

Pump Unit
Figure 006

pockets inserted permanently in the pipes, enabling the sensors to be easily removed or replaced without the need of system draining.

7. Accumulator Pressure Switch Unit

Each of these units comprises two switches that sense either fuel or air under-pressure to illuminate a caption, inscribed ACC, at the fuel management panel.

Both switches have electrical connectors and are mounted together as a single unit in the wing lower fairing close to their associated air supply control units.

Each switch diaphragm operates a sealed microswitch via a linkage. One switch senses the differential pressure between the air pressure at the accumulator and the vent gallery pressure and its microswitch contacts close when the air pressure falls to between 13.5 and 10.5 psig (0.931 and 0.724 bar) to illuminate the ACC caption. The other switch senses the differential pressure between the fuel pressure in the engine feed line and the air pressure at the accumulator and its microswitch contacts close, when the fuel pressure falls to between 1.2 and 0.8 psig (0.083 and 0.055 bar) above the air pressure, to illuminate the ACC caption. The same indication will result if the accumulator diaphragm fails. When the air and fuel pressure rise above their associated switch settings, the ACC caption is extinguished.

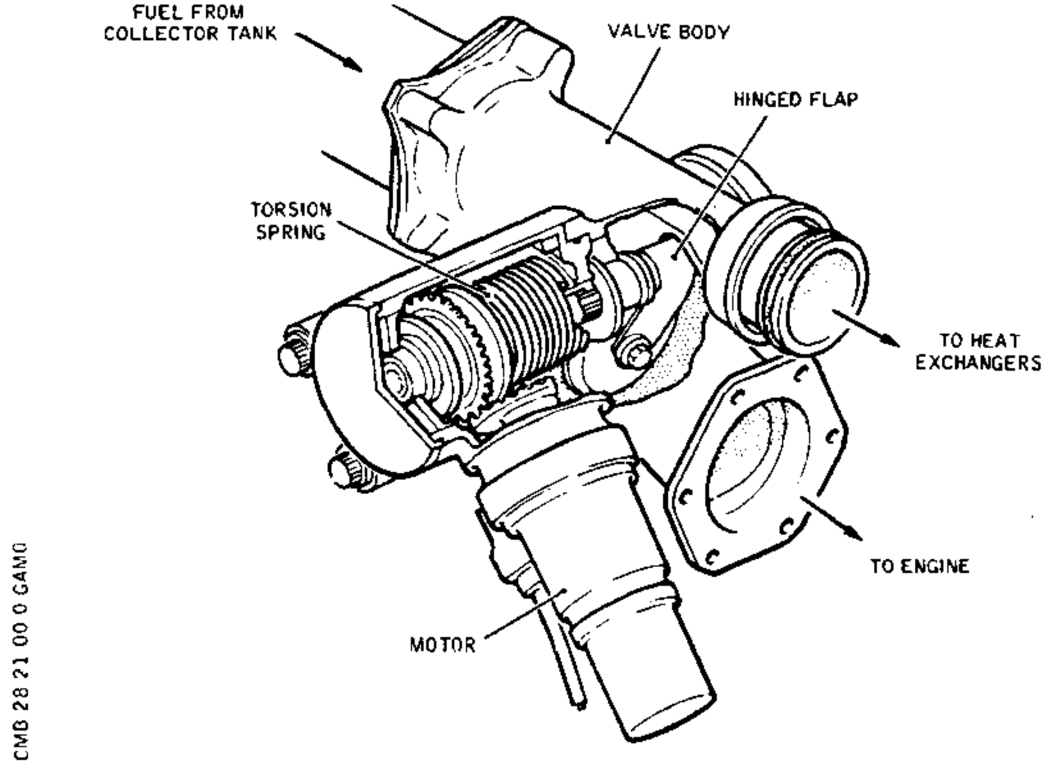
8. Engine Inlet Pressure Switch

This switch forms part of the engine feed low pressure system and is covered in 28-43-00.

9. Pump Pressure Switch (Ref. Fig. 006)

Warning of low pressure output from the feed pumps is given by pressure switches that control captions, inscribed LOW PRESS, on the fuel management panel. Each pump has its own pressure switch, which is located in a sense pipe that connects the outlet port of the pump to the tank. Restrictors are fitted in the sense pipe at the outlet port of the pump to limit the amount of fuel leakage in the event of pipe fracture. The switch has a single diaphragm which operates a sealed microswitch in response to differential fuel pressure sensed from the tank and the engine feed pump outlet. The switches are installed in the wing lower fairing. The microswitch contacts close when pump outlet pressure falls to a minimum of 2 psig (0.138 bar) above tank fuel pressure. The contacts open at a maximum of 3 psig (0.207 bar) when pump pressure rises.

R 10. Bypass Valve (Ref. Fig. 007)



Bypass Valve
Figure 007

R A bypass valve is installed in each supply pipe immediately before the heat exchanger assemblies in the wing dry bays. The valve manifold has an inlet connection with the fuel supply from the collector tank and two outlets, one to the engine supply and the other to the heat exchangers. Mounted between the inlet and engine supply outlet ports is a hinged flap valve normally governed by a torsion spring, but it can be fully opened by an electric motor. Under normal operating conditions, the valve maintains a constant pressure loss between the two ports so that a constant flow of fuel is maintained to the heat exchangers irrespective of the engine supply demand.

R During 'negative G' conditions, when the fuel accumulator discharges, the flap valve is automatically biased fully
R open by a 28 V d.c. electric motor. The motor drive is made through reduction gears and a clutch engaging with the valve spindle; limit switches on the motor control valve movement and indication. The motor may be removed separately

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R from the valve but valve removal necessitates draining the pipelines. A single FUEL LP PROTECTION switch arms all four bypass valve motors to operate automatically; the switch and four valve indicators are on the fuel management panel.

11. Cross-feed Valve (Ref. Fig. 008)

Cross-feed valves control the flow of fuel through the cross-feed pipe at each of its interconnections with the four engine feed pipes. The valve canisters are installed on the inside walls of main tanks 6 and 7, near the main landing gear bays, and the valve elements are accessible in the wing dry bays above the engines.

The valve element comprises an electric motor-driven, spherical plug valve, contained in a canister. The valve element is easily removed from the canister, with automatic sealing of the canister ports making it unnecessary to defuel the tank or pipes. A drain plug enables the canister to be drained of fuel prior to valve removal.

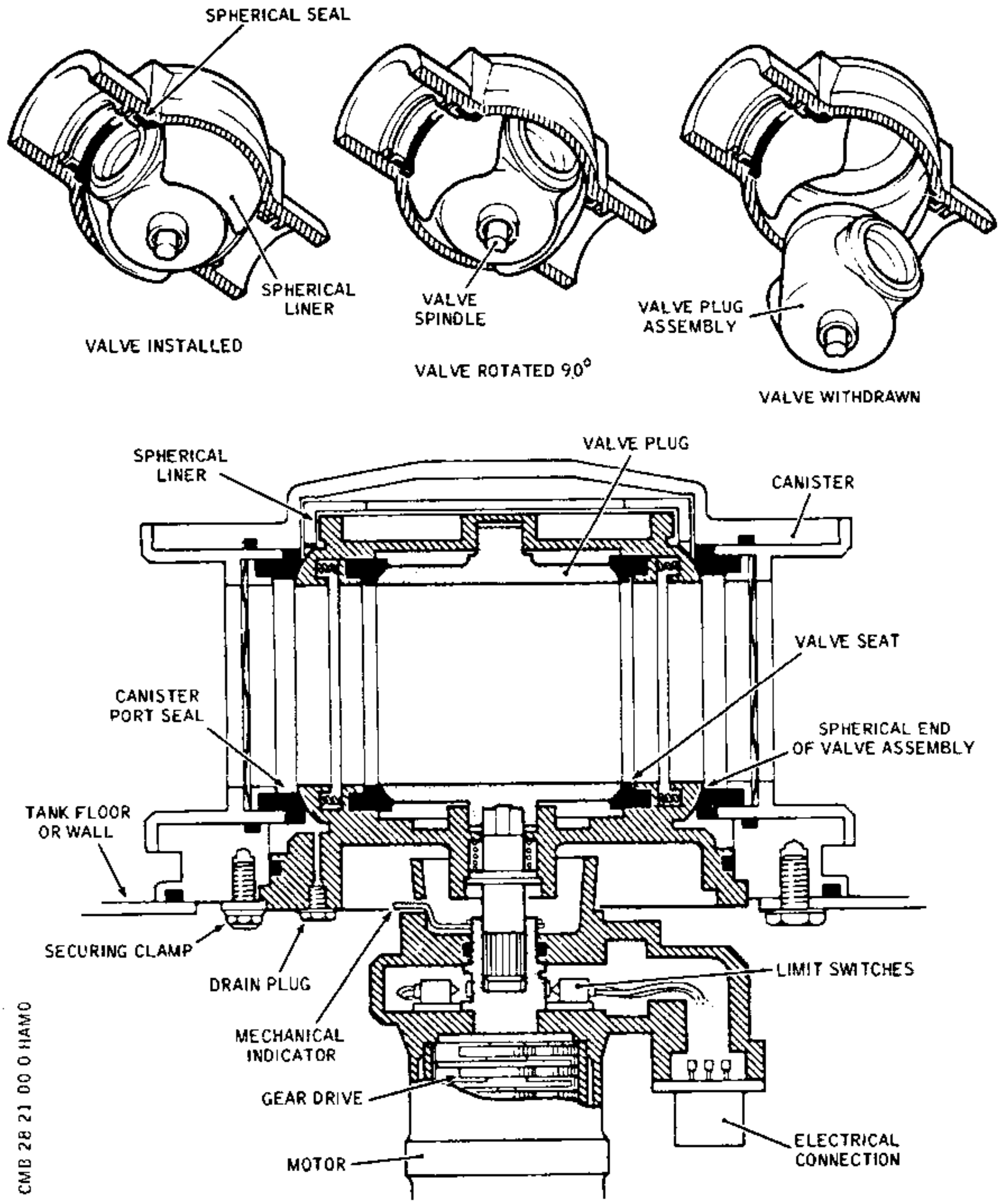
Inside the valve body and bearing on the valve plug are diametrically opposed spring-loaded seats. They form part of the spherical valve ends and provide the sealing arrangement between the valve element and canister. The valve operating spindle is sealed to prevent fuel leakage.

The canister is circular and has two end connections and a mounting flange. Spring-loaded seats inserted in the canister ports provide a seal between the ports and the valve element when the valve element is installed and between the ports and spherical liner when the valve element is withdrawn.

Loosening securing clamps on the canister enables the valve element to be rotated 90 deg, causing the spherical liner to rotate with it. The valve element can then be withdrawn, leaving the spherical liner to remain and seal off the canister ports.

The cross-feed valve element is similar to the 2 in refuel inlet valves which are fitted with non-return valves (Ref. 28-24-00, Description and Operation). A balking pin on the valve body ensures installation of the correct valve element.

A 28 V d.c. electric motor drives the valve spindle through an epicyclic gear train and, to prevent the motor from being overloaded, a pre-set clutch. Limit switches, operated by cams on the final drive shaft, terminate the electrical supply to the motor at each end of valve travel. The switches also



Cross-feed Valve
Figure 008

remotely control the valve magnetic indicator. A mechanical indicator shows the valve position by OPEN and SHUT markings on the motor body. The combined motor and gear unit can be removed without disturbing the valve position.

Each valve has its own control switch and magnetic indicator on the fuel management panel.

12. Drain Valve

The drain valves are situated at the lowest point in the engine feed pipes before the fuel enters the engine nacelles, and enable the pipes and components in the wings to be drained of fuel downstream of the LP isolation valves. The drain valves have spring-loaded sleeves which are opened by removing blanking caps and screwing on a draining tool.

13. Low Pressure Isolation Valve

These valves are located in the wing dry bays, and provide the means of shutting off the supply of fuel from the collector tanks to each engine and other feed system components in the bays. Each valve can either be operated from the fuel management panel, where valve position is indicated by a magnetic indicator, or closed directly by a fire handle on the roof panel above the pilot's station.

The valve assembly is similar to the cross-feed valve, except that the valve plug can be driven by either one or two separate electric motors through a differential epicyclic gear train. Failure of one motor does not affect the operation of the other. A mechanical indicator provides local indication of valve position. The final drive shaft is common to both motors and carries cams which operate the motor limit switches.

The motors use 28 V d.c. power controlled by three-position (SHUT 1 - OPEN - SHUT 2) switches and supplied from different busbars. The combined double motor and gear unit can be removed from the valve assembly without disturbing the position of the valve.

14. Recirculation LP Control Valve (Ref. Fig.009 and 010)
R After SB 28-065

The recirculation control valve ensures that a constant flow of fuel is maintained through the heat exchangers when engine demands are less than the amount required by the heat exchangers. It permits the excess fuel in the engine feed pipe pipe downstream of the heat exchangers to return to the collector tank. The valve, located in the wing dry bay, is

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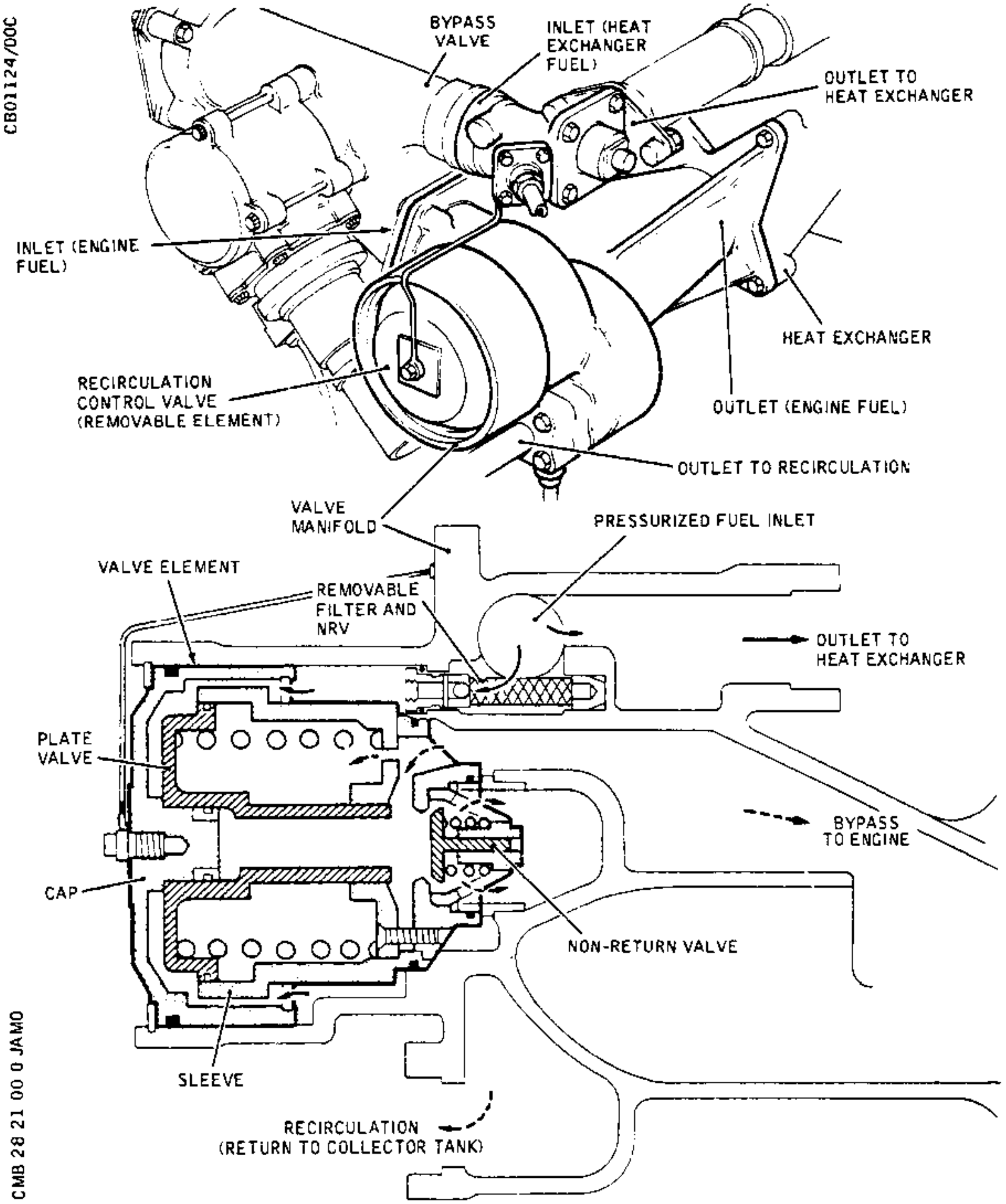

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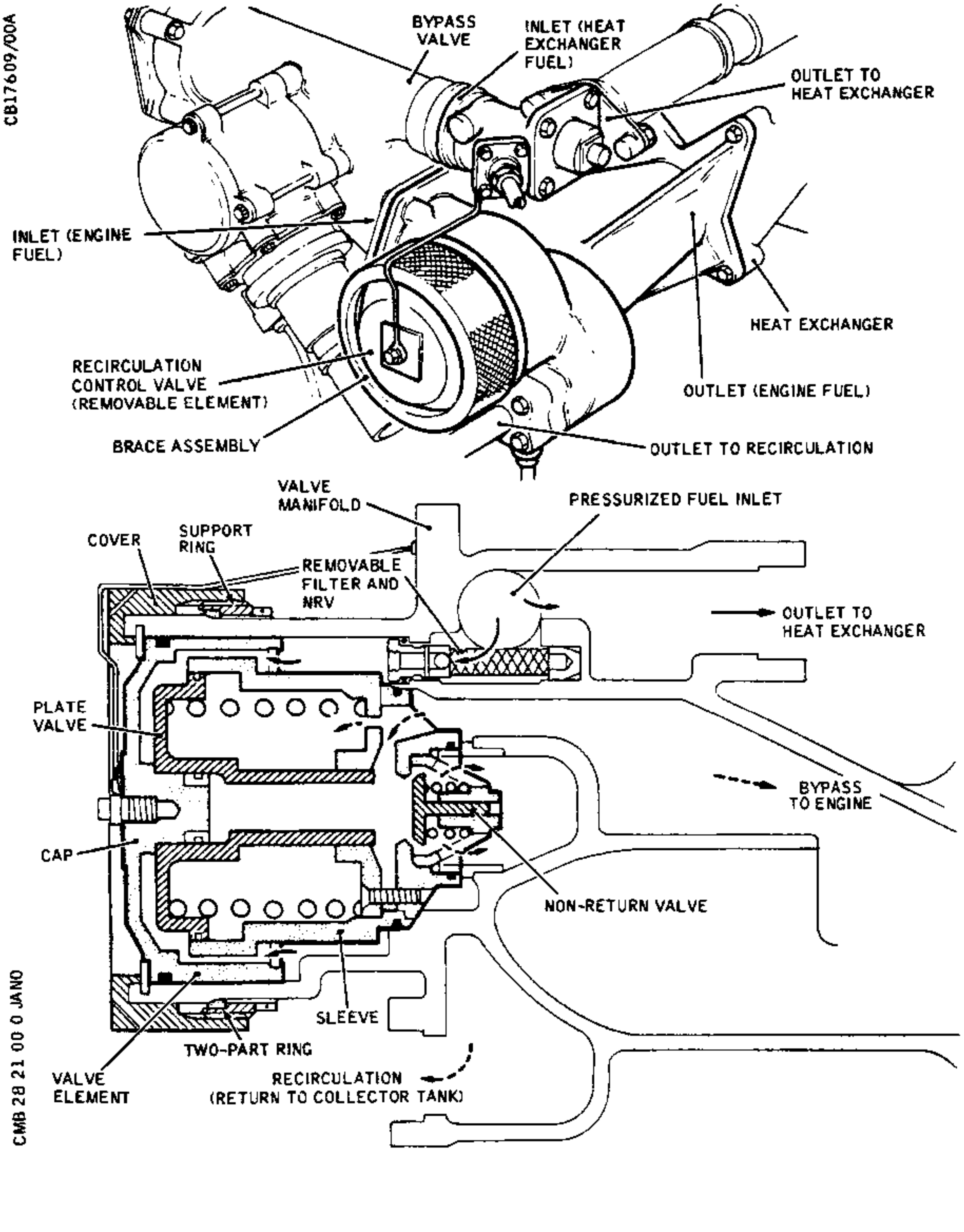
\- Recirculation LP Control Valve
Before SB 28-065
Figure 009

R



\- Recirculation LP Control Valve and Brace Assembly!
Figure 010

R

installed between the bypass valve and the hydraulic heat exchanger assembly in each feed system.

The control valve comprises a manifold and an element. Within the element is a spring-loaded plate valve and a poppet-type non-return valve. The control valve element may be removed from the manifold without disconnecting the pipes, but the system must first be drained, using the drain valve. When the element is removed, the filter/non-return valve may also be withdrawn from the manifold.

R After SB 28-065 For A/C 001-007,

R A brace assembly (Ref. Fig. 010) is fitted to the manifold
R assembly to prevent cracking in the area of the groove for
R the recirculation valve retaining ring. It is necessary to
R remove the brace assembly before removing the recirculation
R valve from the manifold.

Operation of the control valve is automatic as a result of fuel pressure conditions in the valve manifold. The plate valve senses, on one side, filtered pressure from upstream of the heat exchangers, and on its spring side, metered pressure from the downstream side.

When the pressure difference between the two sides is progressively reduced, the spring causes the control valve to open correspondingly and permit fuel to pass through the non-return valve into the recirculation pipe. With increasing pressure difference the control valve remains firmly closed.

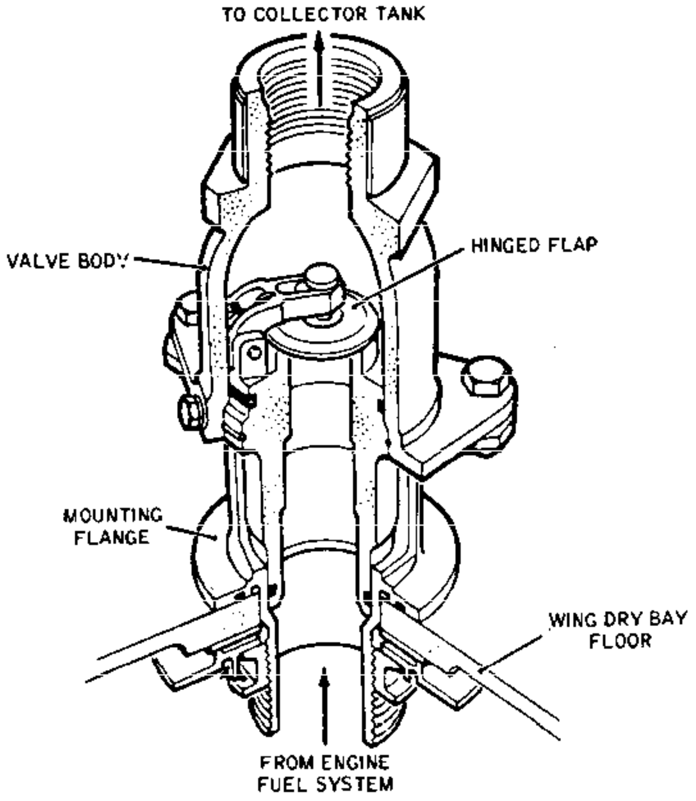
A ball-type non-return valve is fitted in the filter to ensure valve stability at low engine demand.

15. Recirculation Non-return Valve (Ref. Fig. 011)

The valve assembly is simply a hinged non-return flap valve, lightly spring-loaded and contained in a housing mounted vertically through the wing dry bay floor. The valve prevents fuel leakage into the engine nacelle should the recirculation pipe fracture. At the inlet port, under the dry bay floor, the housing is connected to the engine recirculation fuel outlet; above the floor the outlet port is connected to the recirculation pipe to the collector tanks.

16. Recirculation Pressure Holding Valve (Ref. Fig. 012)

One of these valves is mounted on the floor of each



\- Recirculation Non-return Valve
Figure 011

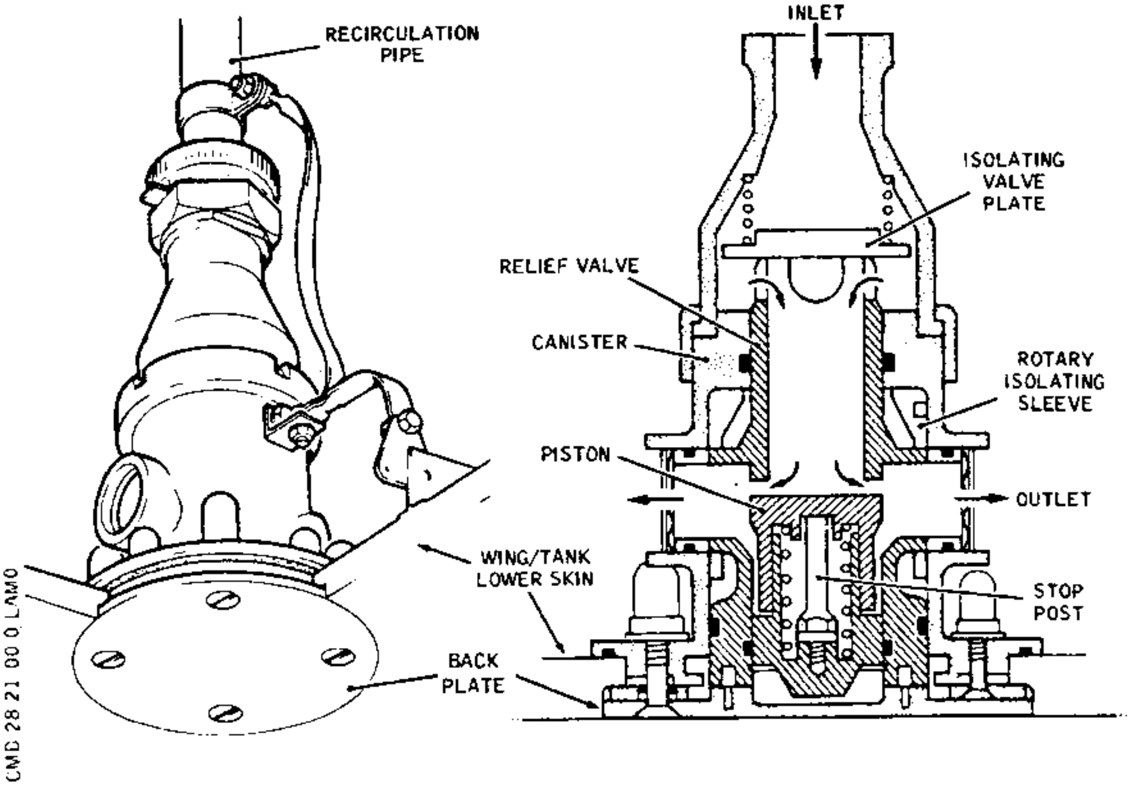
collector tank to maintain sufficient pressure in the recirculation pipes to prevent the hot fuel from boiling. It also disperses the fuel across the collector tank floors to ensure maximum cooling. Each valve assembly comprises a spring-loaded relief valve housed in an isolation canister mounted on the tank floor. Before removal, the valve plug is rotated, causing an isolating sleeve to rotate with it and shut off the fuel at the housing outlet ports. As the valve plug is withdrawn downward from below the tank, a spring closes the isolating valve at the inlet port to shut off the fuel in the recirculation pipe.

17. Operation

A. Control and Indication (Ref. Fig.013 and 014)

Each engine feed system has a group of control switches and indicators on the fuel management panel. The switches and indicators are set out in a fuel flow form with illuminated flow lines inscribed on the panel.

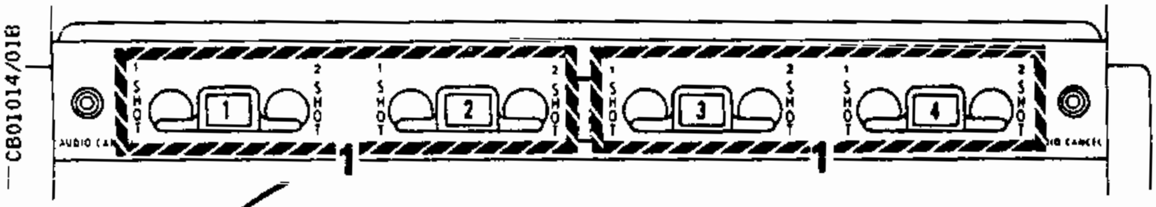
Each engine feed pump is controlled by an ON - OFF switch.

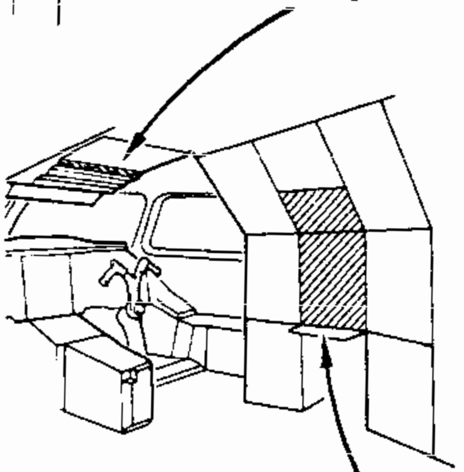


- Recirculation Pressure Holding Valve
Figure 012

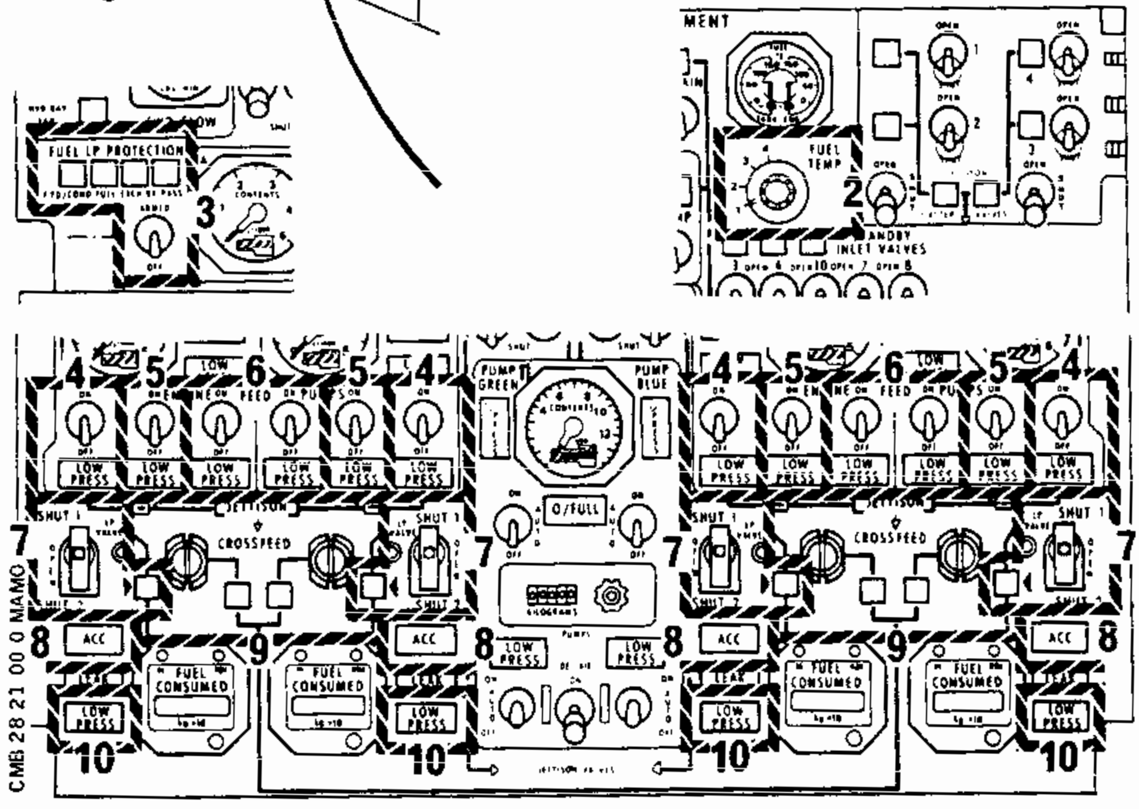
When set to ON, the switch energizes a control relay which provides a 200/115 V, three-phase a.c. supply to the pump motor. A LOW PRESS caption next to the pump switch is illuminated amber with the pump switch at OFF and is extinguished after the pump is switched on and the feed pressure opens the contacts of the pump pressure switch. If the feed pressure falls to 2.0 psig (0.138 bar) above tank fuel pressure then the pressure switch contacts will close, causing the caption to be illuminated and remain so until the pump delivery pressure is restored. Low fuel pressure operation of both the main and first standby pump pressure switches (the aircraft on the ground only) automatically shuts the air-conditioning valve which interrupts the air flow through the air-conditioning system heat exchanger (Ref. 21-11-00).

The control of the first standby pump for tank 2 is linked with the control circuit for tank 5-1 main transfer pump control (Ref. 28-22-00). The linkage is so arranged that the first standby pump for tank 2 is switched off whenever tank 5-1 control switch is set to the EMERG position. A similar arrangement links the first stand-

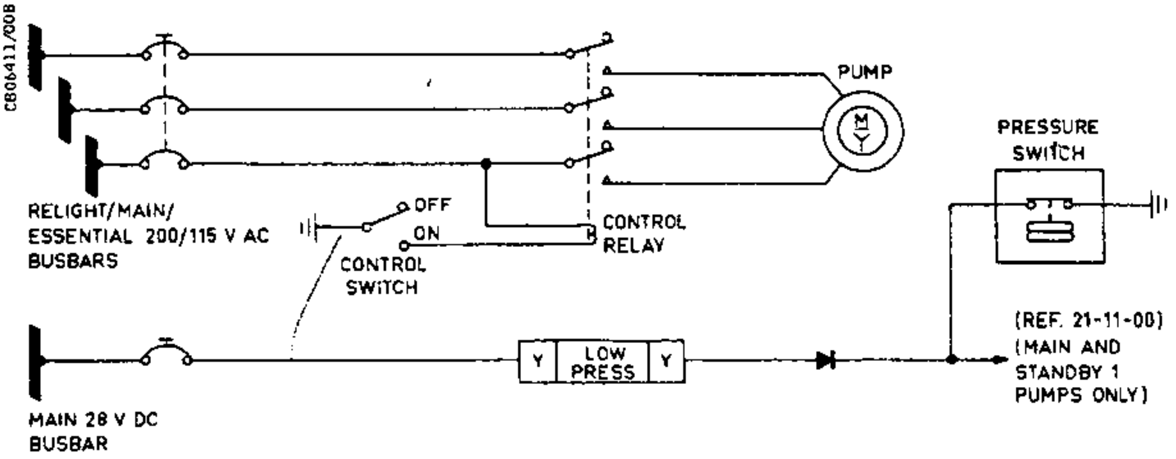




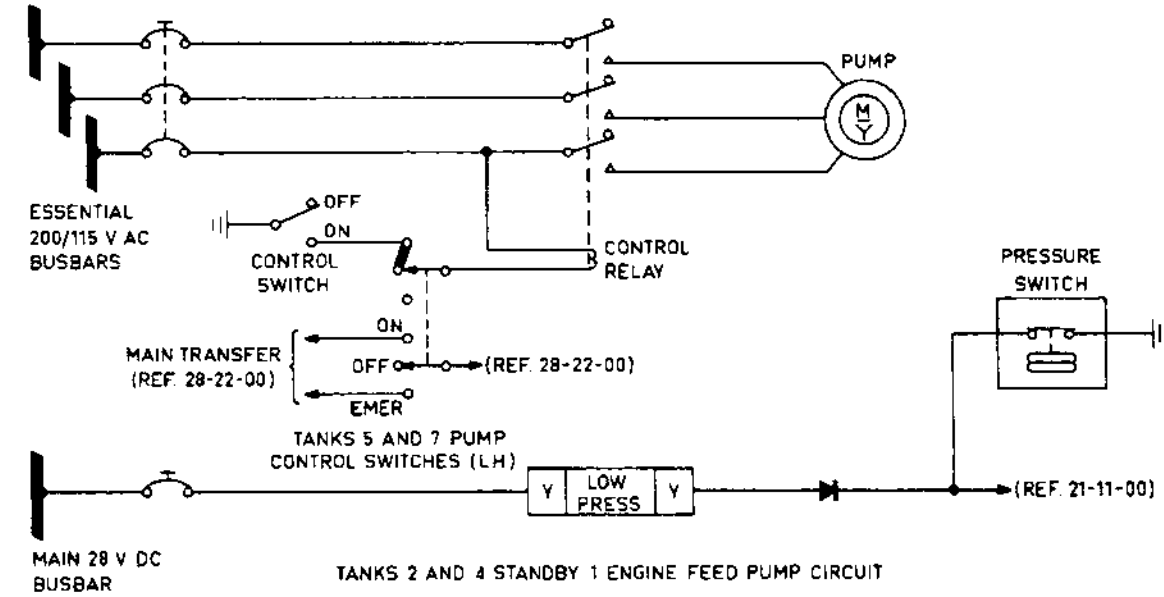
1 FIRE HANDLE
2 ROTARY TEMPERATURE SELECTOR
3 BYPASS VALVE ARMING SWITCH AND INDICATORS
4 MAIN PUMP
5 1st STANDBY
6 2nd STANDBY
} PUMP CONTROL SWITCH AND CAPTION LIGHT
7 LP ISOLATION VALVE SWITCH AND CONTROL FAILURE LIGHT
8 ACCUMULATOR CHARGE/DISCHARGE CAPTION LIGHT
9 CROSS-FEED VALVE SWITCH AND INDICATOR
10 ENGINE FEED LOW PRESSURE CAPTION LIGHT



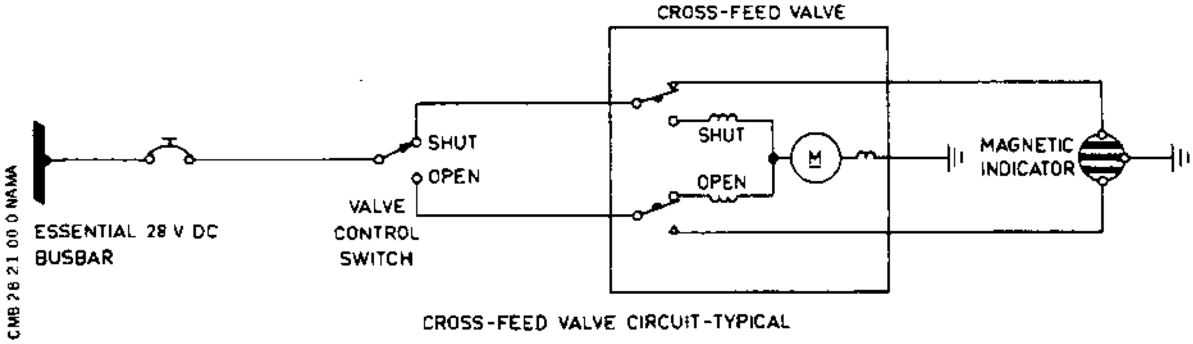
- Engine Feed System - Controls and Indicators
Figure 013



ENGINE FEED PUMP CIRCUIT-EXCEPT TANKS 2 AND 4 STANDBY 1 PUMP

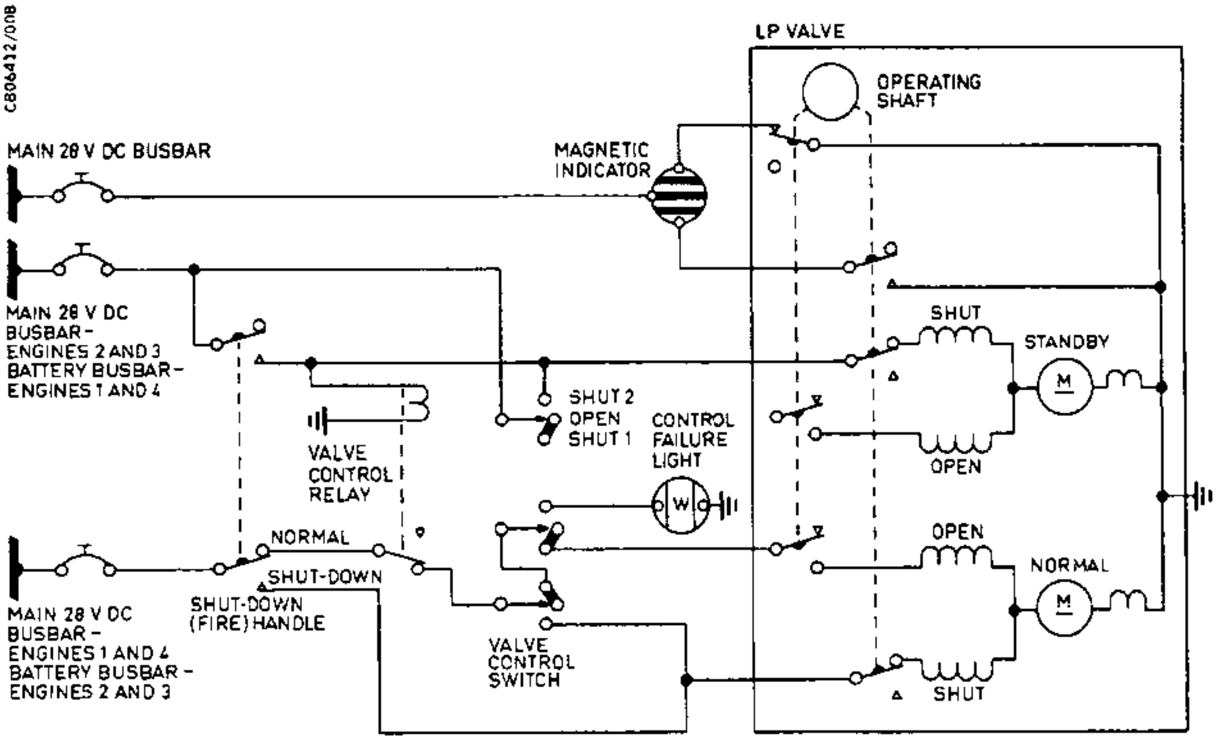


TANKS 2 AND 4 STANDBY 1 ENGINE FEED PUMP CIRCUIT

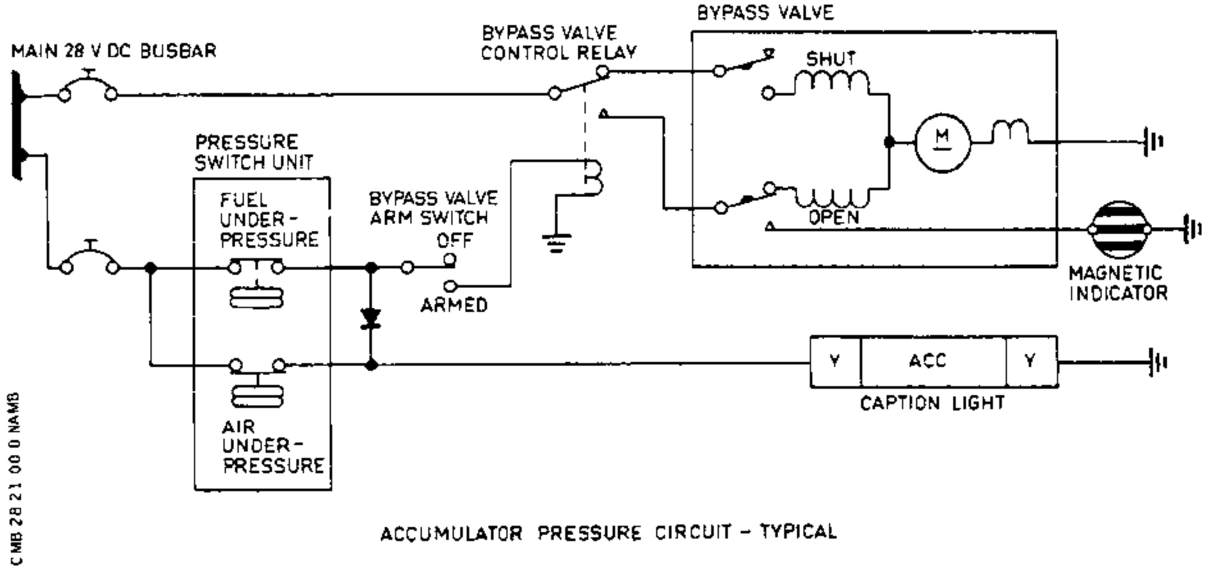


CROSS-FEED VALVE CIRCUIT-TYPICAL

\- Electrical Control and Indication
(Sheet 1 of 2)
Figure 014



LP ISOLATION VALVE CIRCUIT - TYPICAL



ACCUMULATOR PRESSURE CIRCUIT - TYPICAL

- Electrical Control and Indication
(Sheet 2 of 2)
Figure 014

by pump for tank 4 with tank 7-3 main transfer pump.

Each LP isolation valve is controlled by a guarded control switch on the fuel management panel or by the associated shut-down (fire) handle. With the shut-down handle in the normal position, the valve may be shut, using each motor separately, by setting the control switch to either of its shut positions. When the valve is shut by the shut-down handle, both motors are operated simultaneously and the control switch is bypassed.

The supply to each LP valve normal motor is interrupted when the valve control relay is energized by setting the control switch to SHUT 2. The purpose of this relay is to prevent both 'open' and 'shut' signals being supplied simultaneously to the valve if, when the shut-down handle is pulled, one of its microswitches fails to operate.

A control failure light is provided, next to each control switch, to give indication of control relay failure. The light filament is tested by depressing the LIGHTS CTR test switch on the electrical services panel. When the control switch is set to SHUT 2, the light is illuminated white if the relay has failed, but the normal supply to the standby motor will shut the valve.

Indication of the valve position is given by a three-position magnetic indicator which shows a white stripe either in-line or across the flow line for open or shut respectively. The indicator shows diagonal stripes either when the valve is in transit or when the indicator is de-energized.

Each cross-feed valve is controlled directly by its rotary switch and is opened by rotating the switch in line with the panel inscribed flow line. The magnetic indicator presentation is similar to that described for the LP isolation valve.

In the accumulator system, the ACC caption, controlled in different conditions by either of the two under-pressure switches in the accumulator pressure switch unit, gives warning that the full feed capacity of the accumulator is not available either through failure or because it is in process of discharging. When the fuel pressure in the unit falls to between 1.2 and 0.8 psig (0.083 and 0.055 bar) above the accumulator air pressure, the contacts of the fuel under-pressure switch in the unit close. This causes the ACC caption to be illuminated yellow and, if the bypass valve arm LP PROTECTION switch is in the ARMED position, the bypass valve control relay is energized and

the bypass valve is actuated fully open. When the switch contacts open, the ACC caption is extinguished and the bypass valve is free to move under the influence of the fuel flow. The fuel under-pressure switch will also function if the accumulator diaphragm ruptures.

The air under-pressure switch in the accumulator pressure switch units functions when the air pressure in the unit is less than 10.5 psig (0.724 bar) to 13.5 psig (0.931 bar) above vent gallery pressure. In this condition the contacts of the pressure switch close, causing the ACC caption to be illuminated yellow. When the air pressure in the unit is above the switch setting, the switch contacts open and the ACC caption is extinguished. This is the sole function of the switch. During charging of the accumulator the fuel and air pressure will be almost equal, their relative levels depending on the engine feed condition. The ACC caption may or may not be illuminated during charging condition. Indication is displayed by a two-position magnetic indicator which shows OPEN when the bypass valve is actuated to open, and black when the valve is either de-energized or free to move under the influence of the fuel flow.

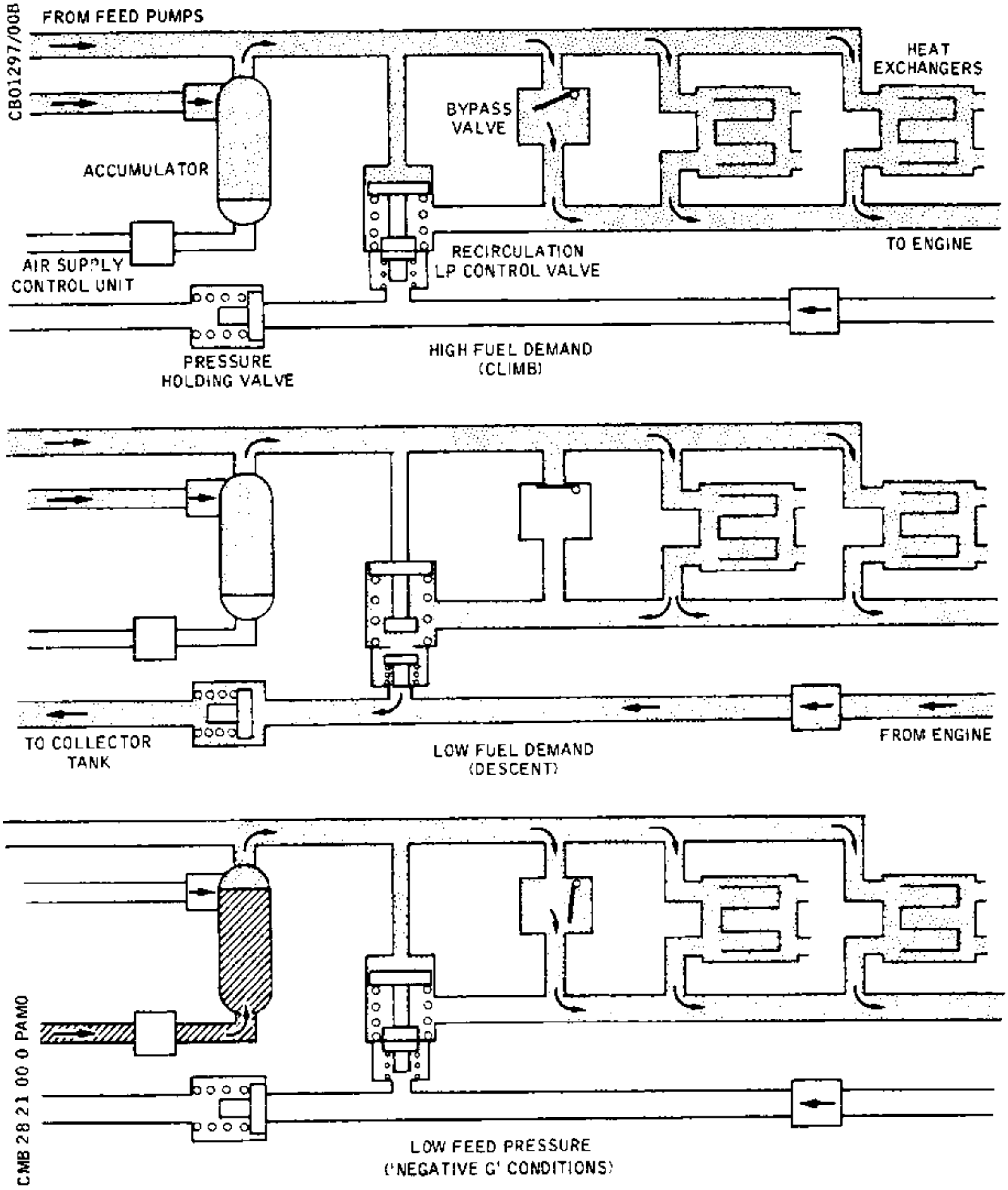
Serviceability of the caption light filaments is checked by depressing the LIGHT CTR push-switch on the electrical services panel.

A rotary selector switch and a single dual-scale indicator enable collector tank fuel outlet and engine fuel inlet temperature indications to be selected for each engine (Ref. 28-45-00).

B. Functional Description (Ref. Fig. 015)

Normally only one feed pump per engine is required, two when reheat is in use. Three pumps per engine are provided as a safety measure. The accumulator non-return valve ensures that the supply from the main feed pumps is reserved for engine feed, but the standby pumps can be used for either engine feed or jettison. The main pumps continue to feed the engines when the standby pumps are being used to jettison fuel; if a main pump fails, the output pressure from the standby pumps, via the accumulator non-return valve, will be sufficient to maintain a feed to the engines, provided that fuel is not being jettisoned.

With the feed pumps started and the LP isolation and cross-feed valves set for system operation, the remaining components function automatically and fuel passes



\- Fuel Bypass and Recirculation - Simplified Schematic
Figure 015

from the collector tanks into the engine fuel systems to suit all conditions of engine demand. The fuel accumulators are pressurized at all times when the engines are running by engine air supplied from the air supply units.

The bypass valves limit the flow of fuel to the heat exchangers to approximately the equivalent of that used by the engines at the end of cruise. The flow through the air-conditioning heat exchangers is also governed by the throttle valve, which operates in response to air temperatures within the air-conditioning system. For high engine demands, such as for take-off and climb, the increased flow of fuel opens the bypass valves accordingly, permitting extra fuel to bypass the exchangers and flow directly into the recirculation valve manifold to join with fuel from the exchangers in supplying the engines.

With low engine demands, as in the descent, the bypass valves close and the total amount of fuel passing through the heat exchangers exceeds engine requirements. The resulting decrease in pressure difference in the supply lines before and after the heat exchanger stage causes the recirculation valves to open and divert the excess fuel back to the collector tanks.

If there is a significant fall in feed pressure, owing to 'negative G' conditions, the fuel accumulators will immediately discharge their contents into the feed pipes. Simultaneously, an underpressure signal from the accumulator pressure switch unit will cause the bypass motors to fully open the valves, so reducing the supply of fuel to the heat exchangers and instead providing an unrestricted flow to the engines.

Upon the pumps restoring the feed pressure, the accumulators will be recharged and a signal from the accumulator pressure switch unit will cause the bypass valve motors to move to their normal position, allowing the valves to return to being operated by fuel pressure difference and so resume the normal supply of fuel to the heat exchangers.

The engine cross-feed is upstream of all the heat exchangers, which arrangement enables flow through the heat exchangers to be maintained in the event of failure of a fuel supply from a collector tank.

18. Electrical Power Supplies

Electrical power supplies for the equipment in the engine feed system are detailed in Table 1.

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
ENGINE FEED PUMPS		
Tank 1, main:-		
Supply and control	No.1 relight 200/115 V a.c.	1-213
Indication	'B' main 28 V d.c.	15-216
Tank 1, standby 1:-		
Supply and control	No.4 essential 200/115 V a.c.	4-213
Indication	'B' main 28 V d.c.	15-216
Tank 1, standby 2:-		
Supply and control	No.3 main 200/115 V a.c.	13-216
Indication	'B' main 28 V d.c.	15-216
Tank 2, main:-		
Supply and control	No.2 relight 200/115 V a.c.	1-213
Indication	'A' main 28 V d.c.	15-215
Tank 2, standby 1:-		
Supply and control	No.3 essential 200/115 V a.c.	4-213
Indication	'A' main 28 V d.c.	15-215
Tank 2, standby 2:-		
Supply and control	No.4 main 200/115 V a.c.	14-216
Indication	'A' main 28 V d.c.	15-215
Tank 3, main:-		
Supply and control	No.3 relight 200/115 V a.c.	1-213

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Indication	'B' main 28 V d.c.	15-216
Tank 3, standby 1:-		
Supply and control	No.3 essential 200/115 V a.c.	4-213
Indication	'B' main 28 V d.c.	15-216
Tank 3, standby 2:-		
Supply and control	No.1 main 200/115 V a.c.	14-215
Indication	'B' main 28 V d.c.	15-216
Tank 4, main:-		
Supply and control	No.4 relight 200/115 V a.c.	1-213
Indication	'A' main 28 V d.c.	15-215
Tank 4, standby 1:-		
Supply and control	No.4 essential 200/115 V a.c.	4-213
Indication	'A' main 28 V d.c.	15-215
Tank 4, standby 2:-		
Supply and control	No.2 main 200/115 V a.c.	13-215
Indication	'A' main 28 V d.c.	15-215
LP ISOLATION VALVES		
No.1 engine:-		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply and control	'A' battery 28 V d.c.	16-215
Indication	'A' main 28 V d.c.	15-215
No.2 engine:-		

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Normal supply and control	'B' battery 28 V d.c.	15-216
Standby supply and control	'A' main 28 V d.c.	15-215
Indication	'B' main 28 V d.c.	15-216
No.3 engine:-		
Normal supply and control	'B' battery 28 V d.c.	15-216
Standby supply and control	'A' main 28 V d.c.	15-215
Indication	'B' main 28 V d.c.	15-216
No.4 engine:-		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply and control	'A' battery 28 V d.c.	16-215
Indication	'A' main 28 V d.c.	15-215
CROSSFEED VALVES		
No.1 engine:-		
Supply, control and indication	'B' essential 28 V d.c.	3-213
No.2 engine:-		
Supply, control and indication	'A' essential 28 V d.c.	1-213
No.3 engine:-		
Supply, control and indication	'A' essential 28 V d.c.	1-213

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
No.4 engine:-		
Supply, control and indication	'B' essential 28 V d.c.	3-213
ACCUMULATOR INDICATION AND HEAT EXCHANGER BYPASS VALVES		
No.1 engine:-		
Acc. indication and valve control	'A' main 28 V d.c.	15-215
Valve supply and indication	'A' main 28 V d.c.	15-215
No.2 engine:-		
Acc. indication and valve control	'B' main 28 V d.c.	15-216
Valve supply and indication	'B' main 28 V d.c.	15-216
No.3 engine:-		
Acc. indication and valve control	'A' main 28 V d.c.	15-215
Valve supply and indication	'A' main 28 V d.c.	15-215
No.4 engine:-		
Acc. indication and valve control	'B' main 28 V d.c.	15-216
Valve supply and indication	'B' main 28 V d.c.	15-216

Electrical Power Supplies
Table 1

ENGINE FEED SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE GENERAL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4., 5., 6.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

Where circuits are similar and incorporate identical components, i.e., Eng. 1, Eng. 2, Eng. 3 and Eng. 4 systems, all references to the associated components listed in Table 101 are given, e.g., 'Renew Crossfeed Valve (57) to (60) as required'. Electrical power should normally be on at the start of all tests.

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Air supply rig, to supply a minimum airflow of 10 scfm(*) (283.2 l/min) at 80 psig (5.5 bar)	-
(*) scfm = standard cubic feet per minute	

B. Prepare

(1) Ensure that the fuel level in the tanks suits the requirements of the particular trouble shooting procedure.

(2) Ensure that circuit breakers (Ref. Table 101) are set.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that the switches on the fuel management panel are at their normal ground positions (Ref. 28-00-00, Servicing).

(5) Display warning placards at the fuel management panel (3CM) and the refuelling control panel (1-194), to indicate that work is being carried out on the fuel system.

3. Trouble Shooting - Crossfeed Valves

```
  ****************************************
A.*Prepare to trouble shoot (Ref. para.2.).*
  *At the 3CM station, panel 5-214, check  *
  *that CROSSFEED control switch is shut,  *
  *i.e., across flow-line engraved on      *
  *panel; check that CROSSFEED position    *
  *indicator displays bar-across-line.     *
  *Check that cross-feed valve mechanical  *
  *indicator is at SHUT.                   *
  *                                        *
  *Set control switch to open, i.e., in-   *
  *line with flow-line engraving on panel. *
  *Check that position indicator display   *
  *goes from bar-across-line to diagonal   *
  *stripes then to bar-in-line.  Check that*
  *mechanical indicator on cross-feed valve*
  *is at OPEN.                             *
  *                                        *
  *Set control switch to shut, i.e., across*
  *flow-line.  Check that position indicat-*
  *or display goes from bar-in-line to     *
  *diagonal stripes then to bar-across-    *
  *line. Check that mechanical indicator on*
  *cross-feed valve is at SHUT.  IF -      *
  ******************************************
                 |
                 |              --------------------------------
                 |             |1.Valve does not open/shut when |
             NOT OK------------|  control switch operated -     |
                               |  Chart 101.                    |
                               |2.Position indicator faulty,    |
                               |  with correct valve operation -|
                               |  Chart 102.                    |
                                --------------------------------
```

4. Trouble Shooting - Low Pressure Isolation Valve

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At the 3CM station, panel 5-214;  check *
  *that LP VALVE control switch is at OPEN *
  *and guarded; check valve position       *
  *indicator displays bar-in-line; check   *
  *mechanical indicator on LP isolation    *
  *valve is at OPEN.                       *
  *                                        *
  *Set control switch to "SHUT 1".  Check  *
  *that position indicator display goes    *
  *from bar-in-line to diagonal stripes    *
  *then to bar-across-line within 1.5 to   *
  *4 s;  check that mechanical indicator on*
  *LP isolation valve is at SHUT.          *
  *                                        *
  *Reset control switch to "OPEN".  Check  *
  *that valve position indicator display   *
  *goes from bar-across-line to diagonal   *
  *stripes then to bar-in-line within 1.5  *
  *to 4 s; check that mechanical indicator *
  *on LP isolation valve is at OPEN.  IF - *
  ******************************************
              |    |
              |    |           --------------------------------
              |    |          |1. Valve does not open/close    |
             OK   NOT OK------|   when control switch operated |
              |               |   OPEN - SHUT 1 - OPEN -       |
              |               |   Chart 103.                   |
              |               |2. Position indicator faulty,   |
              |               |   with correct valve operation |
              |               |   - Chart 104.                 |
              |                --------------------------------
```

```
                 |
B.******************************************
  *At lower electrical service panel       *
  *(6-214), operate LIGHTS CTR switch to   *
  *"TEST". Check that control relay failure*
  *lamp is illuminated white.  Release test*
  *switch; check that lamp is extinguished.*
  *IF -                                    *
  ******************************************
                 |    |
                 |    |                  -------------------------------
                 |    |                 |Control Relay Failure Lamp (73),|
                 OK   NOT OK------------|(74),(75) or (76) is not illum- |
                 |                      |inated, renew filament.         |
                 |                       -------------------------------
                 |
C.******************************************
  *Set control switch to "SHUT 2". Check   *
  *that control relay failure lamp is not  *
  *illuminated; check that position        *
  *indicator display goes from bar-in-line *
  *to diagonal stripes then to bar-across- *
  *line within 1.5 to 4 s; check that      *
  *mechanical indicator at LP isolation    *
  *valve is at SHUT.  IF -                 *
  ******************************************
                 |    |
                 |    |                  -------------------------------
                 |    |                 |1.Control relay failure lamp is |
                 OK   NOT OK------------|  illuminated when control      |
                 |                      |  switch at SHUT 2 but valve and|
                 |                      |  position indicator operation  |
                 |                      |  normal, renew Valve Control   |
                 |                      |  Relay (69),(70),(71) or (72); |
                 |                      |  also check associated wiring  |
                 |                      |  for O/C.                      |
                 |                      |2.Valve does not close when     |
                 |                      |  control switch operated to    |
                 |                      |  SHUT 2 - Chart 105.           |
                 |                      |  NOTE:  Control relay failure  |
                 |                      |         lamp may or may not be |
                 |                      |         illuminated.           |
                 |                       -------------------------------
```

```
                 |
D.*******************************************
  *Trip CB (6),(9),(12) or (15); check that*
  *control relay failure lamp is illumin-  *
  *ated white.  Reset CB (6),(9),(12) or   *
  *(15);  check that lamp is extinguished. *
  *IF -                                    *
  ******************************************
             |    |
             |    |                -------------------------------
             |    |               |Control relay failure lamp is  |
             OK   NOT OK---------|not illuminated when CB tripped,|
             |                    |renew Valve Control Relay (69), |
             |                    |(70),(71) or (72).              |
             |                     -------------------------------
             |
E.*******************************************
  *Reset control switch to "OPEN" and close*
  *guard.  Ensure that valve opens         *
  *satisfactorily (Ref. para.4.A.).        *
  ******************************************
```

5. Trouble Shooting - Engine Feed Pumps

```
A.****************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *Ensure that fuel level in tanks 1, 2, 3 *
  *and 4 is not less than 20 per cent full.*
  *With electrical ground power on, check  *
  *that all ENGINE FEED PUMPS LOW PRESS     *
  *captions are illuminated yellow.  IF -  *
  ******************************************
             |    |
             |    |                  ---------------------------------
             |    |                  |1.Check for 28 V d.c. output at |
             OK   NOT OK-------------|  CB (17),(18),(19),(23),(24),  |
             |                       |  (25),(29),(30),(31),(35) or   |
             |                       |  (36). Renew as required.      |
             |                       |2.Renew filament(s) in Low Pres-|
             |                       |  sure Captions (111) to (120), |
             |                       |  (139) and (140), as required. |
             |                       ---------------------------------
             |
```

NOTE: The following paragraph B. applies to all pumps except for the 1st standby pumps in tanks 2 and 4. These pumps are controlled by the centre switch in the group of three.

```
B.****************************************
  *At fuel management panel (5-214) set    *
  *pump control switch to "ON".            *
  *                                        *
  *Check that pump runs and LOW PRESS      *
  *caption is extinguished within 2 s of   *
  *switch operation.                       *
  *                                        *
  *Set pump control switch to "OFF"; check *
  *that pump stops running and LOW PRESS   *
  *caption is illuminated.  IF -           *
  ******************************************
             |    |
             |    |                  ---------------------------------
             |    |                  |1.Pump runs, but LOW PRESS cap- |
             OK   NOT OK-------------|  tion is not extinguished,when |
             |                       |  pump switched ON - Chart 106. |
             |                       |2.Pump does not run and LOW     |
             |                       |  PRESS caption remains illumin-|
             |                       |  ated when pump switched ON -  |
             |                       |  Chart 107.                    |
             |                       ---------------------------------
```

NOTE: The following paragraph applies to the 1st standby pump in tanks 2 and 4 only. These pumps are controlled by the centre switch in the group of three. Unless otherwise stated, the first number in parenthesis is for the tank 2 feed system; substitute the second number for the tank 4 feed system, e.g., ensure that tank 5 Pump Control Switch (131), (tank 7 (132)), is set to OFF. Set Pump Control Switch (133), (134), to "ON".

C. *To inhibit operation of transfer pumps in tanks 5 and 7, trip the TANK 5-1 PUMP SUP (TANK 7-3 PUMP SUP) circuit breaker Q905 (Q908) on panel 4-213, map ref.D5 (C8).

Ensure that tank 5 Pump Control Switch (131), (tank 7 (132)), is set to OFF. Set Pump Control Switch (133), (134), to "ON".

Check that pump runs and LOW PRESS caption is extinguished within 2 s of switch operation.

Set tank 5 (tank 7) Pump Control Switch (131),(132), to "ON" then to "OFF". Check for no effect on engine feed pumps.

Disengage guard and set tank 5 (tank 7) Pump Control Switch (131),(132), to "EMER". Check that 1st standby engine feed pump stops running, and LOW PRESS caption (139),(140), is illuminated within 3 s. Reset Pump Control Switch (131), (132), to "OFF" and reset guard. Check that engine feed pump starts running and LOW PRESS caption (139),(140), is extinguished.

Set Pump Control Switch (133),(134), to "OFF"; check that pump stops running and LOW PRESS caption is illuminated. IF-*

```
|      |                 --------------------------------
|      |                |1.Pump runs, but LOW PRESS cap- |
OK     NOT OK-----------|  tion is not extinguished when |
|                       |  pump switched ON - Chart 106. |
|                       |2.Pump does not run and LOW     |
|                       |  PRESS caption remains illumin-|
|                       |  ated when pump switched ON -  |
|                       |  Chart 108.                    |
|                       |3.If engine feed pump stops run-|
|                       |  ning when tank 5 (tank 7) Pump|
|                       |  Control Switch (131),(132),   |
|                       |  set to ON, check associated   |
|                       |  wiring for continuity and     |
|                       |  renew Pump Control Switch     |
|                       |  (131),(132), as required.     |
|                       |4.If engine feed pump does not  |
|                       |  stop running when tank 5 (tank|
|                       |  7) Pump Control Switch (131), |
|                       |  (132), set to EMER, check     |
|                       |  associated wiring for contin- |
|                       |  uity and renew Pump Control   |
|                       |  Switch (131),(132), as        |
|                       |  required. If fault not        |
|                       |  cleared, renew Pump Control   |
|                       |  Relay (135),(136), as         |
|                       |  required.                     |
|                        --------------------------------
|
D.********************************************
  *Reset the TANK 5-1 PUMP SUP (TANK 7-3     *
  *PUMP SUP) circuit breaker Q905 (Q908) on*
  *panel 4-213, map ref.D5 (C8).            *
  ******************************************
```

6. Trouble Shooting - Engine Accumulator Indication

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *Ensure that fuel level in tanks 1,2,3   *
  *and 4 is not less than 20 per cent full.*
  *Depressurize accumulator air system by  *
  *removing drain plug from base of        *
  *Accumulator (164) to (167).  Do not     *
  *refit drain plug at this stage.         *
  *                                        *
  *At fuel management panel (2-214), ensure*
  *that FUEL LP PROTECTION control switch  *
  *is at OFF.  Ensure that HYD/COND FUEL   *
  *EXCH BY-PASS valve position indicators  *
  *display black.  IF -                    *
  ******************************************
             |    |
             |    |              --------------------------------
             |    |             |1.Bypass valve position indicat-|
             OK   NOT OK--------|  or displays OPEN when control |
             |                  |  switch is at OFF - Chart 109. |
             |                   --------------------------------
             |
B.*******************************************
  *At panel 5-214, ensure that ENGINE FEED *
  *PUMPS control switches are at OFF.      *
  *Check that ACC captions are illuminated.*
  *IF -                                    *
  ******************************************
             |    |
             |    |              --------------------------------
             |    |             |1.ACC captions are not illumin- |
             OK   NOT OK--------|  ated at start of test - Chart |
             |                  |  110.                          |
             |                   --------------------------------
             |
C.*******************************************
  *At panel 2-214, set ENGINE FEED PUMPS to*
  *"ON".  The ACC captions will remain     *
  *illuminated.  Check, for a period of    *
  *2 min, that there are no fuel leaks from*
  *drain at base of Accumulator (164) to   *
  *(167).  IF -                            *
  ******************************************
             |    |
```

```
          |    |
          |    |                 ------------------------------------
          |    |                |1.If fuel leaks from accumulator|
          OK   NOT OK-----------|  drain, renew damaged          |
          |                     |  Accumulator (164) to (167)    |
          |                     |  diaphragm as required, also,  |
          |                     |  check air Supply Control Unit |
          |                     |  (168) to (171) for fuel       |
          |                     |  contamination. If contaminated|
          |                     |  renew air supply control unit |
          |                     |  as required.                  |
          |                      ------------------------------------
          |
D.*******************************************
  *Refit drain plug to base of Accumulator *
  *(164) to (167).  Leave engine feed pumps*
  *on. Connect air supply rig to ground    *
  *pressurizing connector (Ref. Adjustment/*
  *Test).                                  *
  *Apply air pressure of between 80 and 130*
  *psig (5.5 and 8.9 bar) to system. Check *
  *that ACC caption is extinguished. IF -  *
  *******************************************
          |    |
          |    |                 ------------------------------------
          |    |                |1.ACC caption is not extinguish-|
          OK   NOT OK-----------|  ed when pumps on and air pres-|
          |                     |  sure applied - Chart 111      |
          |                      ------------------------------------
          |
E.*******************************************
  *Set ENGINE FEED PUMPS switches to "OFF".*
  *Check that ACC caption is illuminated.  *
  *IF -                                    *
  *******************************************
          |    |
          |    |                 ====================================
          |    |                |Disconnect electrical connector |
          OK   NOT OK-----------|B from Pressure Switch (160) to |
          |                     |(163). Check fixed connector    |
          |                     |pins A-B for continuity.  If O/C|
          |                     |found, renew Pressure Switch    |
          |                     |(160) to (163), as required.    |
          |                      ====================================
          |
```

```
                |
                |
F.*******************************************
  *Leave air pressure on and set FUEL LP    *
  *PROTECTION switch to "ARMED".  With ACC  *
  *caption illuminated, check that HYD/COND*
  *FUEL EXCH BY-PASS indicator display      *
  *changes from black to OPEN within 2 s    *
  *and the motor of the bypass valve is     *
  *heard to run.  IF -                      *
  ******************************************
                |    |
                |    |              --------------------------------
                |    |             |1.If valve position indicator  |
                OK   NOT OK--------|  displays OPEN immediately     |
                |                  |  control switch is set to ARMED|
                |                  |  reset control switch to "OFF".|
                |                  |  Disconnect electrical         |
                |                  |  connector from Bypass Valve   |
                |                  |  (147) to (150).  Check fixed  |
                |                  |  connector for O/C between pins|
                |                  |  C-E. If continuity found,     |
                |                  |  renew Bypass Valve (147) to   |
                |                  |  (150), as required.           |
                |                  |2.Bypass valve position indicat-|
                |                  |  or does not display OPEN when |
                |                  |  control switch set to ARMED - |
                |                  |  Chart 112.                    |
                |                   --------------------------------
                |
G.*******************************************
  *With air supply still on, set ENGINE     *
  *FEED PUMPS switches to "ON". Check that  *
  *within 2 to 3 s, the ACC caption is ex-  *
  *tinguished and the valve position indi-  *
  *cator display changes to black and the   *
  *motor of the Bypass Valve (147) to (150)*
  *is heared to run closed.  IF -           *
  ******************************************
                |    |
```

```
        |    |             ----------------------------------
        |    |            |1.If valve motor not heard to     |
        OK   NOT OK-------|  run shut, disconnect electri-   |
        |                 |  cal connector at Bypass Valve   |
        |                 |  (147) to (150).  Check free     |
        |                 |  connector for 28 V d.c. at pin  |
        |                 |  B, if no volts, check assoc-    |
        |                 |  iated wiring before renewing    |
        |                 |  Control Relay (143) to (146)    |
        |                 |  as required. If 28 V at pin     |
        |                 |  B, renew Bypass Valve motor     |
        |                 |  (147) to (150) as required.     |
        |                  ----------------------------------
        |
******************************************
*Set FUEL LP PROTECTION switch to "OFF". *
*Set ENGINE FEED PUMPS switches to "OFF".*
*Disconnect air supply rig from ground   *
*pressurizing connector (Ref. Adjustment/*
*Test).                                  *
******************************************
```

VALVE DOES NOT OPEN/SHUT WHEN CONTROL SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

With electrical power on, and control switch at 'shut', disconnect electrical connector at Cross-feed Valve (57),(58),(59) or (60). Check free connector for 28 V d.c. at pin C. With control switch at 'open', check free connector for 28 V d.c. at pin B.

-YES- With cross-feed valve at 'shut', check for continuity through valve fixed connector pins B-A. With valve at 'open', check for continuity through pins C-A.

--NO- Renew Cross-feed Valve (57), (58), (59) or (60).

NO

Check CB (1), (2),(3) or (4) for 28 V d.c. output.

-YES- *Renew Control Switch (49),(50), (51) or (52), as required.

NO

Renew CB (1),(2), (3) or (4).

Chart 101

POSITION INDICATOR FAULTY,
WITH CORRECT VALVE OPERATION.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

Disconnect electrical connector at Cross-feed Valve (57), (58),(59) or (60).

----- With cross-feed valve shut, check for continuity through valve fixed connector, pins C-E. With valve open, check for continuity through pins B-D.

-YES- *Renew Position Indicator (53), (54),(55) or (56).

NO

Renew Cross-feed Valve (57),(58), (59) or (60).

Chart 102

```
***********************************     --------------------------------
*VALVE DOES NOT OPEN/CLOSE WHEN*       |GROUND EQUIPMENT REQUIRED       |
*CONTROL SWITCH OPERATED 'OPEN'*       |--------------------------------|
*-'SHUT 1' - 'OPEN'.           *       |DESCRIPTION           PART NO.  |
***********************************    |--------------------------------|
                                       |GROUND POWER SUPPLY   -         |
                                       |MULTIMETER            -         |
                                        --------------------------------

 -----------        -----------        -----------          -----------
|Repeat test|      |Disconnect |      |With LP    |        |Renew LP   |
|(Ref. para.|------|electrical |-YES-|valve open,|--NO-|Isolation  |
|4.A.).     |      |connector A|      |check for  |        |Valve (61),|
|Leave elec-|      |from LP    |      |continuity |        |(62),(63)  |
|trical     |      |Valve (61),|      |at fixed   |        |or (64).   |
|power on.  |      |(62),(63)  |      |connector  |         -----------
 -----------       |or (64).   |      |A, pins C-A|
                   |With cont- |      |Check for  |
                   |rol switch |      |O/C at pins|
                   |at OPEN,   |      |B-A. With  |
                   |check free |      |LP valve   |
                   |connector A|      |shut, check|
                   |for 28 V   |      |for contin-|
                   |d.c. at pin|      |uity at    |
                   |B. With    |      |fixed conn-|
                   |control    |      |ector A,   |
                   |switch at  |      |pins B-A;  |
                   |SHUT 1,    |      |check for  |
                   |check free |      |O/C at pins|
                   |connector A|      |C-A.       |
                   |for 28 V   |       -----------
                   |d.c. at pin|
                   |C.         |
                    -----------
                         |
                         NO
                         |
 -----------        -----------
|Renew CB   |      |Check CB   |
|(5),(8),   |-NO--|(5),(8),   |
|(11) or    |      |(11) or    |
|(14).      |      |(14) for   |
 -----------       |28 V d.c.  |
                   |output.    |
                    -----------
                         |
                        YES
```

Continued on Sheet 2

Chart 103 (Sheet 1 of 2)

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```
                    Continued from Sheet 1
                              |
                         -----------            -----------           -----------
                        |At Control |          |With Cont-  |        |Renew Cont-|
                        |Switch     |-YES-     |rol switch  |--NO-   |rol Switch |
                        |(65),(66), |          |at SHUT 1   |        |(65),(66), |
                        |(67) or    |          |check for   |        |(67) or    |
                        |(68), check|          |28 V d.c.   |        |(68).      |
                        |for 28 V   |          |at terminal |         -----------
                        |d.c. input |          |4. With     |
                        |at terminal|          |control     |
                        |5.         |          |switch at   |
                         -----------           |OPEN, check |
                              |                |for 28 V    |
                              NO               |d.c. at     |
                              |                |terminal 1. |
 -----------             -----------            -----------
|Check elec-|           |Remove     |
|trical     |-NO--      |Valve Cont-|
|supplies   |           |rol Relay  |
|and associ-|           |(69),(70), |
|ated wiring|           |(71) or    |
|through    |           |(72). Check|
|Engine     |           |for 28 V   |
|Shut-Down  |           |d.c. supply|
|Handle     |           |to relay   |
|(Fire      |           |socket pin |
|Handle)    |           |A2.        |
|Ref.       |            -----------
|26-22-00). |                 |
 -----------                  YES
                              |
                    --------------          --------------
                   |Check control |        |Renew Valve   |
                   |relay for cont-|--NO-  |Control Relay |
                   |inuity through |       |(69),(70),(71)|
                   |terminals A2-  |       |or (72).      |
                   |A3.            |        --------------
                    --------------
                              |
                              YES
                              |
                    --------------
                   |Check associat-|
                   |ed wiring for  |
                   |O/C.           |
                    --------------
```

Chart 103 (Sheet 2 of 2)

```
**********************************   ---------------------------------
*POSITION INDICATOR FAULTY,      *  |GROUND EQUIPMENT REQUIRED        |
*WITH CORRECT VALVE OPERATION.   *  |---------------------------------|
**********************************  |DESCRIPTION              PART NO.|
                                    |---------------------------------|
                                    |GROUND POWER SUPPLY      -       |
                                    |MULTIMETER               -       |
                                     =================================

 ------------       ------------       ------------
|Repeat test |     |Check CB    |     |Renew CB    |
|(Ref. para. |-----|(7),(10),   |-NO-|(7),(10),    |
|4.A.). Leave|     |(13) or (16)|    |(13) or (16)|
|electrical  |     |for 28 V    |      ------------
|power on.   |     |d.c. output.|
 ------------       ------------
                          |
                         YES
                          |
 -----------        -----------        -----------        -----------
|Check asso-|      |At Valve   |      |Disconnect |      |Renew Valve|
|ciated wir-|-NO--|Position    |-YES-|wires at    |--NO-|Position    |
|ing for O/C|      |Indicator  |      |terminals A|      |Indicator  |
 -----------       |(77),(78), |      |and C.     |      |(77),(78), |
                   |(79) or    |      |Check that |      |(79) or    |
                   |(80), check|      |position   |      |(80).      |
                   |for 28 V   |      |indicator  |       -----------
                   |d.c. at    |      |displays   |
                   |terminal B.|      |diagonal   |
                    -----------       |stripes.   |
                                       -----------
                                            |
                                           YES
                                            |
                       Continued on Sheet 2
```

Chart 104 (Sheet 1 of 2)

Continued from Sheet 1

Provide independent earth to indicator terminal C. Check that indicator displays bar-in-line. Disconnect earth from terminal C. Apply earth to terminal A. Check that indicator displays bar-across-line. Reconnect wires to terminals.

-NO- → Renew Valve Position Indicator (77), (78), (79) or (80).

-YES- ← Disconnect electrical connectors A, B and C from LP Valve (61), (62), (63) or (64). With LP valve open, check for continuity through fixed connector C, pin B, and either pin A at fixed connectors A and B. With LP valve shut, check for continuity through fixed connector C, pin C, and either pin A at fixed connectors A and B.

-NO- → Renew LP Isolation Valve (61), (62), (63) or (64).

YES → Check associated wiring for O/C.

Chart 104 (Sheet 2 of 2)

VALVE DOES NOT CLOSE WHEN CONTROL SWITCH OPERATED TO 'SHUT 2".

NOTE: Control failure lamp may or may not be illuminated.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Repeat test (Ref. para. 4.C.). Leave electrical power on.

→ With control failure lamp illuminated, check Valve Control Switch (65), (66),(67) or (68) for 28 V d.c. input at terminal 8.

- NO → Check CB (6),(9), (12) or (15) for 28 V d.c. output.
  - NO → Renew CB (6),(9), (12) or (15).
- YES → With control switch at SHUT 2, check for 28 V d.c. at terminal 9.
  - NO → Renew Valve Control Switch (65) (66), (67) or (68).

→ With control failure lamp not illuminated, disconnect electrical connectors A and B from LP Valve (61),(62), (63) or (64). Ensure control Switch at SHUT 2. Check for 28 V d.c. at free connector B, pin C.

- YES → Check LP valve for continuity through valve fixed connector B, pin C, and either pin A in fixed connectors B and A.
  - NO → Renew LP Isolation Valve (61), (62),(63) or (64).

Chart 105

```
*********************************
*PUMP RUNS, BUT 'LOW PRESS'     *
*CAPTION IS NOT EXTINGUISHED,   *
*WHEN PUMP SWITCHED 'ON'.       *
*********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------      -----------       -----------        -----------
|Repeat test|    |Disconnect |     |Renew      |      |Check      |
|(Ref. para.|----|electrical |--NO-|Pressure   |--NO-|Engine Feed|
|5.B. or C.)|    |connector  |     |Switch     |      |Pump (91)  |
|Leave pump |    |from Press-|     |(121) to   |      |to (100),  |
|switch at  |    |ure Switch |     |(130),     |      |(137),(138)|
|ON.        |    |(121) to   |     |(141),     |      |filter for |
 -----------     |(130),     |     |(142), as  |      |blockage.  |
                 |(141),     |     |required.  |      |Is fault   |
                 |(142).     |     |Is fault   |      |cleared?   |
                 |Check for  |     |cleared?   |       -----------
                 |O/C at     |      -----------             |
                 |fixed      |                              NO
                 |connector  |                              |
                 |pins A and |                         -----------
                 |B.         |                        |Check      |
                  -----------                         |pressure   |
                                                      |switch     |
                                                      |sense line |
                                                      |for        |
                                                      |blockage.  |
                                                       -----------
```

Chart 106

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PUMP DOES NOT RUN AND 'LOW PRESS' CAPTION REMAINS ILLUMINATED WHEN PUMP SWITCHED 'ON'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

[Repeat test (Ref. para. 5.B.). Leave pump switch at at ON.] ---- [Disconnect electrical connector at Engine Feed Pump (91) to (100), as required. Check free connector for 200/115 V a.c. 3-ph supply.]

- YES → [Renew Engine Feed Pump (91) to (100), as required]
- NO → [At fuel contactor box (panel 22-123 or 24-123), remove Pump Control Relay (81) to (90), as required and check for 115 V a.c. supply at relay socket pins A2, B2 and C2.]

[At fuel contactor box ... socket pins A2, B2 and C2.]

- NO → [Check CB (20), (21), (22); (26), (28); (32), (33), (34); (38), (40), as required for 200/115 V a.c. 3-ph output.]
  - NO → [Renew CB as required.]
- YES → [Check for 115 V a.c. across relay socket pins X1 and X2.]
  - YES → [*Renew Pump Control Relay (81) to (90), as required.]
  - NO → [*Renew Pump Control Switch (101) to (110).]

Chart 107

PUMP DOES NOT RUN AND 'LOW' PRESS' CAPTION REMAINS ILLUMINATED WHEN PUMP SWITCHED 'ON'

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Repeat test (Ref. para. 5.C.). Leave pump switch at ON. — Disconnect electrical connector at Engine Feed Pump (137),(138), as required. Check free connector for 200/115 V a.c. 3-ph supply.

- YES: Renew Engine Feed Pump (137),(138), as required.
- NO: At fuel contactor box panel 22-123 (panel 24-123) remove Pump Control Relay (135),(136), and check for 115 V a.c. supply at socket pins A2,B2 and C2.
  - NO: Check CB (27),(39), for 200/115 a.c. 3-ph supply.
    - NO: Renew CB (27),(39), as required
  - YES: Check for 115 V a.c. across relay socket pins X1 and X2.
    - YES: Renew Pump Control Relay (135), (136), as required.
    - NO: Ensure tank 5 (tank 7) Pump Control Switch (131) (132), is OFF and check for continuity through terminals 8-7.
      - NO: Renew Pump Control Switch (131), (132) as required.
      - YES: With Pump Control Switch (133), (134), at ON, check for continuity through terminals 1-2.
        - NO: Renew Pump Control Switch (133),(134) as required.

Chart 108

BYPASS VALVE POSITION INDICATOR DISPLAYS 'OPEN' WHEN CONTROL SWITCH IS AT 'OFF'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

At Valve Position Indicator (151) to (154), check for 28 V d.c. supply to terminal A.

- YES → At Control Switch (155), check for 28 V d.c. output at - terminal 1 - eng.1, terminal 4 - eng.2, terminal 7 - eng.3, terminal 10 - eng.4.
  - NO → *Renew Valve Control Relay (143) to (146), as required.
  - YES → Renew Control Switch (155).
- NO → Renew Valve Position Indicator (151) to (154) as required.

Chart 109

'ACC' CAPTIONS ARE NOT ILLUMINATED AT START OF TEST.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

At lower electrical service panel (6-214), set LIGHTS CTR switch to "TEST" Check that ACC captions are illuminated

-YES- Check CB (43) to (48) for 28 V d.c. output.

-YES- Check for 28 V d.c. on terminal 3 of Accumulator Caption (156) to (159) as required.

-YES- Renew Accumulator Caption (156) to (159) as required.

(Check for 28 V d.c. on terminal 3 ...) NO: *Renew Pressure Switch (160) to (163) as required.

(Check CB (43) to (48) ...) NO: Renew CB (43) to (48) as required.

(At lower electrical service panel ...) NO: Renew filaments in Accumulator Captions (156) to (159) as required.

Chart 110

ACC CAPTION IS NOT EXTINGUISHED WHEN PUMPS ON AND AIR PRESSURE APPLIED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Repeat test (Ref. para.6.D.). Leave pumps and air pressure on.

→ Disconnect electrical connectors A and B from Pressure Switches (160) to (163). Check fixed connectors A and B for O/C at pins A-B.

— NO → If continuity found at fixed connector B, renew Pressure Switch (160) to (163) as required.

NO ↓

If continuity found at fixed connector A, check Air Supply Control Unit (168) to (171) for correct delivery pressures.

— YES → Renew Pressure Switch (160) to (163), as required.

NO ↓

Renew Air Supply Control Unit (168) to (171), as required.

Chart 111

BYPASS VALVE POSITION INDICATOR DOES NOT DISPLAY 'OPEN' WHEN CONTROL SWITCH SET TO 'ARMED'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

Repeat test (Ref. para.6.F.). Leave control switch at ARMED. --- Check for 28 V d.c. output at CB (41) to (46).

- NO: Renew appropriate CB (41) to (46).
- YES: At Control Switch (155), check for 28 V d.c. output at:-
  terminal 1 - eng. 1,
  terminal 4 - eng. 2,
  terminal 7 - eng.3,
  terminal 10 - eng.4.
  - NO: *Renew Control Switch (155).
  - YES: Disconnect electrical connector from Bypass Valve (147) to (150). Check for 28 V d.c. at free connector pin C.
    - NO: *Renew Valve Control Relay (143) to (146) as required.
    - YES: Check valve fixed connector for continuity through pins C-E.
      - NO: Renew Bypass Valve (147) to (150) as required.
      - YES: *Renew Valve Position indicator (151) to (154), as required.

Chart 112

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1) Circuit breaker 28 V d.c.	-	3-213	1Q41	Map ref.B5	24-50-00 R/I	28-21-07
(2) Circuit breaker 28 V d.c.	-	1-213	2Q41	Map ref.K11	24-50-00 R/I	28-21-07
(3) Circuit breaker 28 V d.c.	-	1-213	3Q41	Map ref.K12	24-50-00 R/I	28-21-07
(4) Circuit breaker 28 V d.c.	-	3-213	4Q41	Map ref.B6	24-50-00 R/I	28-21-07
(5) Circuit breaker 28 V d.c.	-	15-216	1Q1	Map ref.C1	24-50-00 R/I	28-21-05
(6) Circuit breaker 28 V d.c.	-	16-215	1Q2	-	24-50-00 R/I	28-21-05
(7) Circuit breaker 28 V d.c.	-	15-215	1Q3	Map ref.C21	24-50-00 R/I	28-21-05
(8) Circuit breaker 28 V d.c.	-	15-216	2Q1	Map ref.F2	24-50-00 R/I	28-21-05
(9) Circuit breaker 28 V d.c.	-	15-215	2Q2	Map ref.C19	24-50-00 R/I	28-21-05
(10) Circuit breaker 28 V d.c.	-	15-216	2Q3	Map ref.C3	24-50-00 R/I	28-21-05
(11) Circuit breaker 28 V d.c.	-	15-216	3Q1	Map ref.F1	24-50-00 R/I	28-21-06
(12) Circuit	-	15-215	3Q2	Map ref.C20	24-50-00	28-21-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
breaker 28 V d.c.					R/I	
(13) Circuit breaker 28 V d.c.	-	15-216	3Q3	Map ref.C4	24-50-00 R/I	28-21-06
(14) Circuit breaker 28 V d.c.	-	15-216	4Q1	Map ref.C2	24-50-00 R/I	28-21-06
(15) Circuit breaker 28 V d.c.	-	16-215	4Q2	-	24-50-00 R/I	28-21-06
(16) Circuit breaker 28 V d.c.	-	15-215	4Q3	Map ref.C22	24-50-00 R/I	28-21-06
(17) Circuit breaker 28 V d.c.	-	15-216	1Q831	Map ref.B1	24-50-00 R/I	28-21-01
(18) Circuit breaker 28 V d.c.	-	15-216	1Q832	Map ref.B2	24-50-00 R/I	28-21-01
(19) Circuit breaker 28 V d.c.	-	15-216	1Q833	Map ref.B3	24-50-00 R/I	28-21-01
(20) Circuit breaker 200/115 V a.c.	-	1-213	1Q834	Map ref.J3	24-50-00 R/I	28-21-01
(21) Circuit breaker 200/115 V a.c.	-	4-213	1Q835	Map ref.F5	24-50-00 R/I	28-21-01
(22) Circuit breaker 200/115 V a.c.	-	13-216	1Q836	Map ref.D1	24-50-00 R/I	28-21-01
(23) Circuit breaker 28 V	-	15-215	2Q831	Map ref.B19	24-50-00 R/I	28-21-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
d.c.						
(24) Circuit breaker 28 V d.c.	-	15-215	2Q832	Map ref.B20	24-50-00 R/I	28-21-02
(25) Circuit breaker 28 V d.c.	-	15-215	2Q833	Map ref.B21	24-50-00 R/I	28-21-02
(26) Circuit breaker 200/115 V a.c.	-	1-213	2Q834	Map ref.L3	24-50-00 R/I	28-21-02
(27) Circuit breaker 200/115 V a.c.	-	4-213	2Q835	Map ref.B5	24-50-00 R/I	28-21-02
(28) Circuit breaker 200/115 V a.c.	-	14-216	2Q836	Map ref.F4	24-50-00 R/I	28-21-02
(29) Circuit breaker 28 V d.c.	-	15-216	3Q831	Map ref.B4	24-50-00 R/I	28-21-03
(30) Circuit breaker 28 V d.c.	-	15-216	3Q832	Map ref.B5	24-50-00 R/I	28-21-03
(31) Circuit breaker 28 V d.c.	-	15-216	3Q833	Map ref.B6	24-50-00 R/I	28-21-03
(32) Circuit breaker 200/115 V a.c.	-	1-213	3Q834	Map ref.N3	24-50-00 R/I	28-21-03
(33) Circuit breaker 200/115 V a.c.	-	4-213	3Q835	Map ref.A8	24-50-00 R/I	28-21-03
(34) Circuit breaker 200/115 V a.c.	-	14-215	3Q836	Map ref.G14	24-50-00 R/I	28-21-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(35) Circuit breaker 28 V d.c.	-	15-215	4Q831	Map ref.B22	24-50-00 R/I	28-21-04
(36) Circuit breaker 28 V d.c.	-	15-215	4Q832	Map ref.B23	24-50-00 R/I	28-21-04
(37) Circuit breaker 28 V d.c.	-	15-215	4Q833	Map ref.B24	24-50-00 R/I	28-21-04
(38) Circuit breaker 200/115 V a.c.	-	1-213	4Q834	Map ref.Q3	24-50-00 R/I	28-21-04
(39) Circuit breaker 200/115 V a.c.	-	4-213	4Q835	Map ref.F8	24-50-00 R/I	28-21-04
(40) Circuit breaker 200/115 V a.c.	-	13-215	4Q836	Map ref.G16	24-50-00 R/I	28-21-04
(41) Circuit breaker 28 V d.c.	-	15-215	1Q762	Map ref.F24	24-50-00 R/I	28-21-08
(42) Circuit breaker 28 V d.c.	-	15-216	2Q762	Map ref.E5	24-50-00 R/I	28-21-08
(43) Circuit breaker 28 V d.c.	-	15-215	1Q761	Map ref.F22	24-50-00 R/I	28-21-08
(44) Circuit breaker 28 V d.c.	-	15-216	2Q761	Map ref.E3	24-50-00 R/I	28-21-08
(45) Circuit breaker 28 V d.c.	-	15-215	3Q762	Map ref.F25	24-50-00 R/I	28-21-09
(46) Circuit	-	15-216	4Q762	Map ref.E6	24-50-00	28-21-09

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
breaker 28 V d.c.					R/I	
(47) Circuit breaker 28 V d.c.	-	15-215	3Q761	Map ref.F23	24-50-00 R/I	28-21-09
(48) Circuit breaker 28 V d.c.	-	15-216	4Q761	Map ref.E4	24-50-00 R/I	28-21-09
(49) Cross-feed control switch	-	5-214	1Q42	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(50) Cross-feed control switch	-	5-214	2Q42	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(51) Cross-feed control switch	-	5-214	3Q42	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(52) Cross-feed control switch	-	5-214	4Q42	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(53) Cross-feed position indicator	-	5-214	1Q43	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(54) Cross-feed position indicator	-	5-214	2Q43	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(55) Cross-feed position indicator	-	5-214	3Q43	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(56) Cross-feed position indicator	-	5-214	4Q43	Fuel management panel (3CM)	28-00-00 R/I	28-21-07
(57) Cross-feed valve	531 AT	-	1Q44	Left wing dry bay	28-21-17 R/I	28-21-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(58) Cross-feed valve	531 AT	-	2Q44	Left wing dry bay	28-21-17 R/I	28-21-07
(59) Cross-feed valve	631 AT	-	3Q44	Right wing dry bay	28-21-17 R/I	28-21-07
(60) Cross-feed valve	631 AT	-	4Q44	Right wing dry bay	28-21-17 R/I	28-21-07
(61) LP isolation valve	531 AT	-	1Q6	Left wing dry bay	28-21-43 R/I	28-21-05
(62) LP isolation valve	531 AT	-	2Q6	Left wing dry bay	28-21-43 R/I	28-21-05
(63) LP isolation valve	631 AT	-	3Q6	Right wing dry bay	28-21-43 R/I	28-21-06
(64) LP isolation valve	631 AT	-	4Q6	Right wing dry bay	28-21-43 R/I	28-21-06
(65) LP valve control switch	-	5-214	1Q5	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(66) LP valve control switch	-	5-214	2Q5	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(67) LP valve control switch	-	5-214	3Q5	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(68) LP valve control switch	-	5-214	4Q5	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(69) Valve control relay	-	12-215	1Q4	LH flight compartment racking	28-21-00 R/I	28-21-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(70) Valve control relay	-	12-215	2Q4	LH flight compartment racking	28-21-00 R/I	28-21-05
(71) Valve control relay	-	12-216	3Q4	RH flight compartment racking	28-21-00 R/I	28-21-06
(72) Valve control relay	-	12-216	4Q4	RH flight compartment racking	28-21-00 R/I	28-21-06
(73) Control relay failure lamp	-	5-214	1Q8	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(74) Control relay failure lamp	-	5-214	2Q8	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(75) Control relay failure lamp	-	5-214	3Q8	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(76) Control relay failure lamp	-	5-214	4Q8	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(77) Valve position indicator	-	5-214	1Q7	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(78) Valve position indicator	-	5-214	2Q7	Fuel management panel (3CM)	28-00-00 R/I	28-21-05
(79) Valve position indicator	-	5-214	3Q7	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(80) Valve position indicator	-	5-214	4Q7	Fuel management panel (3CM)	28-00-00 R/I	28-21-06
(81) Pump	-	22-123	1Q843	LH fuel	28-00-00	28-21-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
control relay				contactor box, fwd. under-floor racking	R/I	
(82) Pump control relay	-	22-123	1Q844	LH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-01
(83) Pump control relay	-	22-123	1Q845	LH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-01
(84) Pump control relay	-	22-123	2Q843	LH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-02
(85) Pump control relay	-	22-123	2Q845	LH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-02
(86) Pump control relay	-	24-123	3Q843	RH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-03
(87) Pump control relay	-	24-123	3Q844	RH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-03
(88) Pump control relay	-	24-123	3Q845	RH fuel contactor box, fwd. under-floor	28-00-00 R/I	28-21-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				racking		
(89) Pump control relay	-	24-123	4Q843	RH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-04
(90) Pump control relay	-	24-123	4Q845	RH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-04
(91) Engine feed pump	193 EB	-	1Q849	Bottom inbd., tank 1	28-21-13 R/I	28-21-01
(92) Engine feed pump	193 DB	-	1Q850	Bottom inbd., tank 1	28-21-13 R/I	28-21-01
(93) Engine feed pump	193 BB	-	1Q851	Bottom inbd., tank 1	28-21-13 R/I	28-21-01
(94) Engine feed pump	195 GB	-	2Q849	Bottom inbd., tank 2	28-21-13 R/I	28-21-02
(95) Engine feed pump	197 EB	-	2Q851	Bottom inbd., tank 2	28-21-13 R/I	28-21-02
(96) Engine feed pump	196 GB	-	3Q849	Bottom inbd., tank 3	28-21-13 R/I	28-21-03
(97) Engine feed pump	198 BB	-	3Q850	Bottom inbd., tank 3	28-21-13 R/I	28-21-03
(98) Engine feed pump	198 EB	-	3Q851	Bottom inbd., tank 3	28-21-13 R/I	28-21-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(99) Engine feed pump	194 EB	-	4Q849	Bottom inbd., tank 4	28-21-13 R/I	28-21-04
(100) Engine feed pump	194 BB	-	4Q851	Bottom inbd., tank 4	28-21-13 R/I	28-21-04
(101) Pump control switch	-	5-214	1Q840	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(102) Pump control switch	-	5-214	1Q841	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(103) Pump control switch	-	5-214	1Q842	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(104) Pump control switch	-	5-214	2Q840	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(105) Pump control switch	-	5-214	2Q842	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(106) Pump control switch	-	5-214	3Q840	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(107) Pump control switch	-	5-214	3Q841	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(108) Pump control switch	-	5-214	3Q842	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(109) Pump control switch	-	5-214	4Q840	Fuel management panel (3CM)	28-00-00 R/I	28-21-04
(110) Pump	-	5-214	4Q842	Fuel	28-00-00	28-21-04

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
control switch				management panel (3CM)	R/I	
(111) Low pressure caption	-	5-214	1Q837	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(112) Low pressure caption	-	5-214	1Q838	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(113) Low pressure caption	-	5-214	1Q839	Fuel management panel (3CM)	28-00-00 R/I	28-21-01
(114) Low pressure caption	-	5-214	2Q837	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(115) Low pressure caption	-	5-214	2Q839	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(116) Low pressure caption	-	5-214	3Q837	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(117) Low pressure caption	-	5-214	3Q838	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(118) Low pressure caption	-	5-214	3Q839	Fuel management panel (3CM)	28-00-00 R/I	28-21-03
(119) Low pressure caption	-	5-214	4Q837	Fuel management panel (3CM)	28-00-00 R/I	28-21-04
(120) Low pressure caption	-	5-214	4Q839	Fuel management panel (3CM)	28-00-00 R/I	28-21-04
(121) Pressure switch	193 AB	-	1Q846	Bottom inbd.,	28-21-15 R/I	28-21-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				tank 1		
(122) Pressure switch	195 AB	-	1Q847	Bottom inbd., tank 1	28-21-15 R/I	28-21-01
(123) Pressure switch	193 AB	-	1Q848	Bottom inbd., tank 1	28-21-15 R/I	28-21-01
(124) Pressure switch	195 GB	-	2Q846	Bottom inbd., tank 2	28-21-15 R/I	28-21-02
(125) Pressure switch	197 DB	-	2Q848	Bottom inbd., tank 2	28-21-15 R/I	28-21-02
(126) Pressure switch	196 GB	-	3Q846	Bottom inbd., tank 3	28-21-15 R/I	28-21-03
(127) Pressure switch	198 BB	-	3Q847	Bottom inbd., tank 3	28-21-15 R/I	28-21-03
(128) Pressure switch	198 DB	-	3Q848	Bottom inbd., tank 3	28-21-15 R/I	28-21-03
(129) Pressure switch	194 AB	-	4Q846	Bottom inbd., tank 4	28-21-15 R/I	28-21-04
(130) Pressure switch	194 AB	-	4Q848	Bottom inbd., tank 4	28-21-15 R/I	28-21-04
(131) Pump control switch	-	5-214	Q927	Fuel management panel (3CM)	28-00-00 R/I	28-22-06
(132) Pump control switch	-	5-214	Q930	Fuel management panel (3CM)	28-00-00 R/I	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(133) Pump control switch	-	5-214	2Q841	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(134) Pump control switch	-	5-214	4Q841	Fuel management panel (3CM)	28-00-00 R/I	28-21-04
(135) Pump control relay	-	22-123	2Q844	LH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-02
(136) Pump control relay	-	24-123	4Q844	RH fuel contactor box, fwd. under-floor racking	28-00-00 R/I	28-21-04
(137) Engine feed pump	197 BB	-	2Q850	Bottom inbd., tank 2	28-21-13 R/I	28-21-02
(138) Engine feed pump	194 DB	-	4Q850	Bottom inbd., tank 4	28-21-13 R/I	28-21-04
(139) Low pressure caption	-	5-214	2Q838	Fuel management panel (3CM)	28-00-00 R/I	28-21-02
(140) Low pressure caption	-	5-214	4Q838	Fuel management panel (3CM)	28-00-00 R/I	28-21-04
(141) Pressure switch	197 BB	-	2Q847	Bottom inbd., tank 2	28-21-15 R/I	28-21-02
(142) Pressure switch	194 AB	-	4Q847	Bottom inbd., tank 4	28-21-15 R/I	28-21-04
(143) Valve	-	15-123	1Q766	LH fuel	28-00-00	28-21-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
control relay				relay box, fwd. under-floor racking	R/I	
(144) Valve control relay	-	15-123	2Q766	LH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-21-08
(145) Valve control relay	-	18-123	3Q766	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-21-09
(146) Valve control relay	-	18-123	4Q766	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-21-09
(147) Bypass valve	532 AT	-	1Q769	Wing dry bay	28-21-41 R/I	28-21-08
(148) Bypass valve	531 AT	-	2Q769	Wing dry bay	28-21-41 R/I	28-21-08
(149) Bypass valve	631 AT	-	3Q769	Wing dry bay	28-21-41 R/I	28-21-09
(150) Bypass valve	632 AT	-	4Q769	Wing dry bay	28-21-41 R/I	28-21-09
(151) Valve position indicator	-	2-214	1Q764	Fuel management panel (3CM)	28-00-00 R/I	28-21-08
(152) Valve position indicator	-	2-214	2Q764	Fuel management panel (3CM)	28-00-00 R/I	28-21-08
(153) Valve position	-	2-214	3Q764	Fuel management	28-00-00 R/I	28-21-09

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
indicator				panel (3CM)		
(154) Valve position indicator	-	2-214	4Q764	Fuel management panel (3CM)	28-00-00 R/I	28-21-09
(155) Control switch	-	2-214	Q763	Fuel management panel (3CM)	28-00-00 R/I	28-21-08
(156) Accum-ulator caption	-	5-214	1Q765	Fuel management panel (3CM)	28-00-00 R/I	28-21-08
(157) Accum-ulator caption	-	5-214	2Q765	Fuel management panel (3CM)	28-00-00 R/I	28-21-08
(158) Accum-ulator caption	-	5-214	3Q765	Fuel management panel (3CM)	28-00-00 R/I	28-21-09
(159) Accum-ulator caption	-	5-214	4Q765	Fuel management panel (3CM)	28-00-00 R/I	28-21-09
(160) Pressure switch	193 EB	-	1Q768	Wing-root fairing	28-21-14 R/I	28-21-08
(161) Pressure switch	195 KB	-	2Q768	Wing-root fairing	28-21-14 R/I	28-21-08
(162) Pressure switch	196 KB	-	3Q768	Wing-root fairing	28-21-14 R/I	28-21-09
(163) Pressure switch	194 EB	-	4Q768	Wing-root fairing	28-21-14 R/I	28-21-09
(164) Accum-ulator	523 AB	-	-	Tank 1	28-21-11 R/I A/T	-
(165) Accum-ulator	526 AB	-	-	Tank 2	28-21-11 R/I A/T	-
(166) Accum-	626 AB	-	-	Tank 3	28-21-11	-

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
ulator					R/I A/T	
(167) Accum- ulator	623 AB	-	-	Tank 4	28-21-11 R/I A/T	-
(168) Air supply control unit	193 EB	-	-	Wing bottom fairing	28-21-12 R/I	-
(169) Air supply control unit	195 JB	-	-	Wing bottom fairing	28-21-12 R/I	-
(170) Air supply control unit	196 JB	-	-	Wing bottom fairing	28-21-12 R/I	-
(171) Air supply control unit	194 EB	-	-	Wing bottom fairing	28-21-12 R/I	-

Component Identification
Table 101

ENGINE FEED SYSTEM - SERVICING

1. General

The engine feed pipeline must be drained of residual fuel before any part of the pipeline is dismantled or before it is disconnected from the engine. The pipeline can be drained either at the drain valve in the dry bay above the nacelle or at the engine, as expedient.

2. Engine Feed Pipeline Drainage - Dry Bay (Ref. Fig. 301)

A. Equipment and Materials

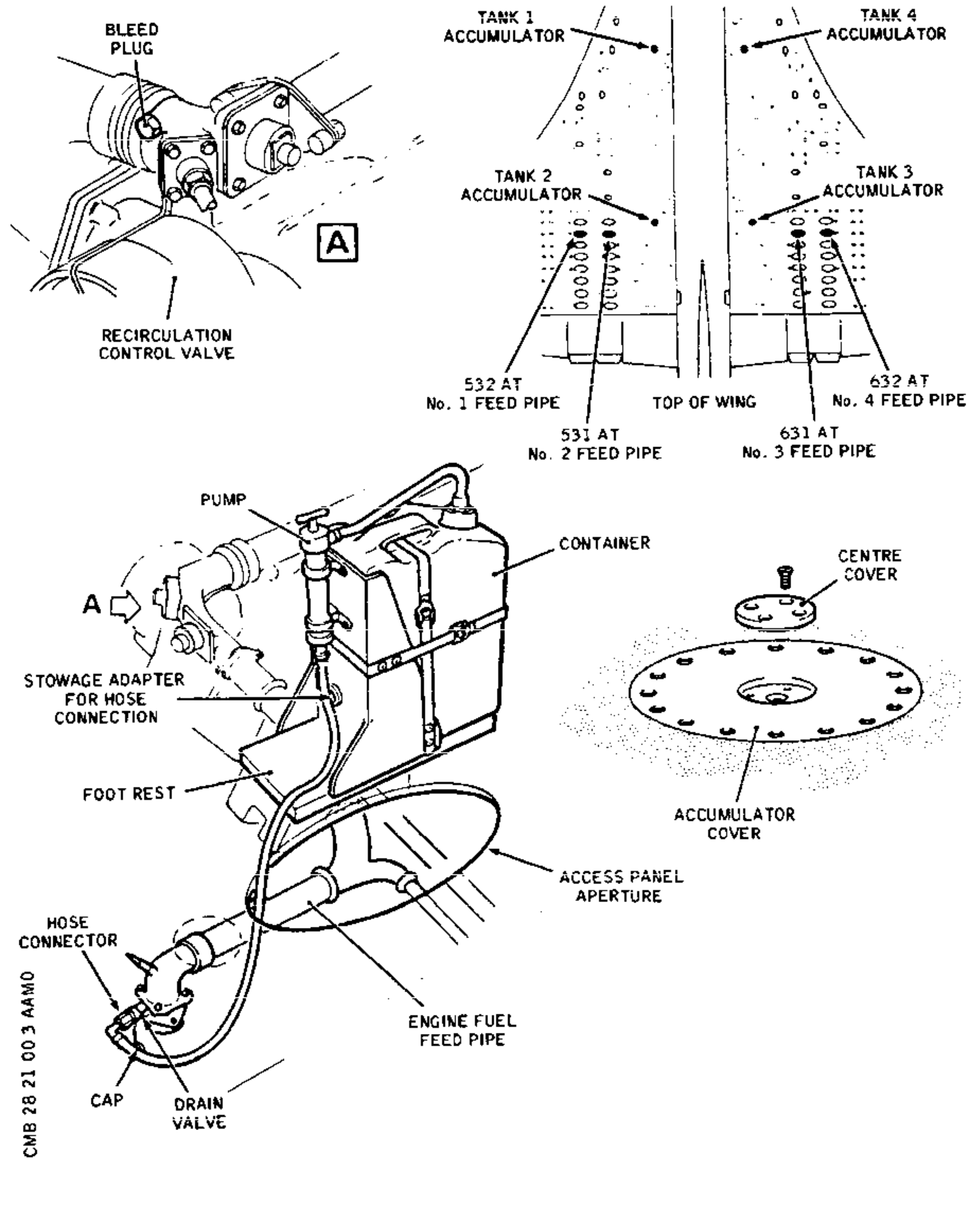
DESCRIPTION	PART NO.
Drain equipment	D925377000
Safety clips, circuit breakers	-

B. Draining Procedure

(1) Remove the appropriate access panel to gain access to the drain valve.

(2) Trip the circuit breakers for the associated engine feed pumps:

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 1, pump supply main	1-213	1Q834	J 3
Tank 1, pump supply 1st standby	4-213	1Q835	F 5
Tank 1, pump supply 2nd standby	13-216	1Q836	D 1
Tank 2, pump supply main	1-213	2Q834	L 3
Tank 2, pump supply 1st standby	4-213	2Q835	B 5
Tank 2, pump supply 2nd standby	14-216	2Q836	F 4
Tank 3, pump supply main	1-213	3Q834	N 3
Tank 3, pump supply 1st standby	4-213	3Q835	A 8
Tank 3, pump supply 2nd standby	14-215	3Q836	G14



- Engine Feed Pipeline - Drainage at Dry Bay
Figure 301

Tank 4, pump supply main	1-213	4Q834	Q 3
Tank 4, pump supply 1st standby	4-213	4Q835	F 8
Tank 4, pump supply 2nd standby	13-215	4Q836	G16

(3) Remove the cap from the drain valve and connect the drain equipment pipe coupling.

(4) Remove the bleed plug from the recirculation valve or remove the air bleed centre cover from the top of the accumulator.

(5) Pump the fuel from the feed pipe into the container.

(6) Remove the drain equipment; refit and wirelock the valve cap and bleed screw or accumulator cover.

(7) Reset the pump circuit breaker.

(8) Refit the access panel.

3. Engine Feed Pipeline Drainage - Engine (Ref. Fig. 302)

A. Equipment and Materials

DESCRIPTION	PART NO.
Drain assembly	PE 19431
Receptacle for fuel	-
Safety clips, circuit breakers	-

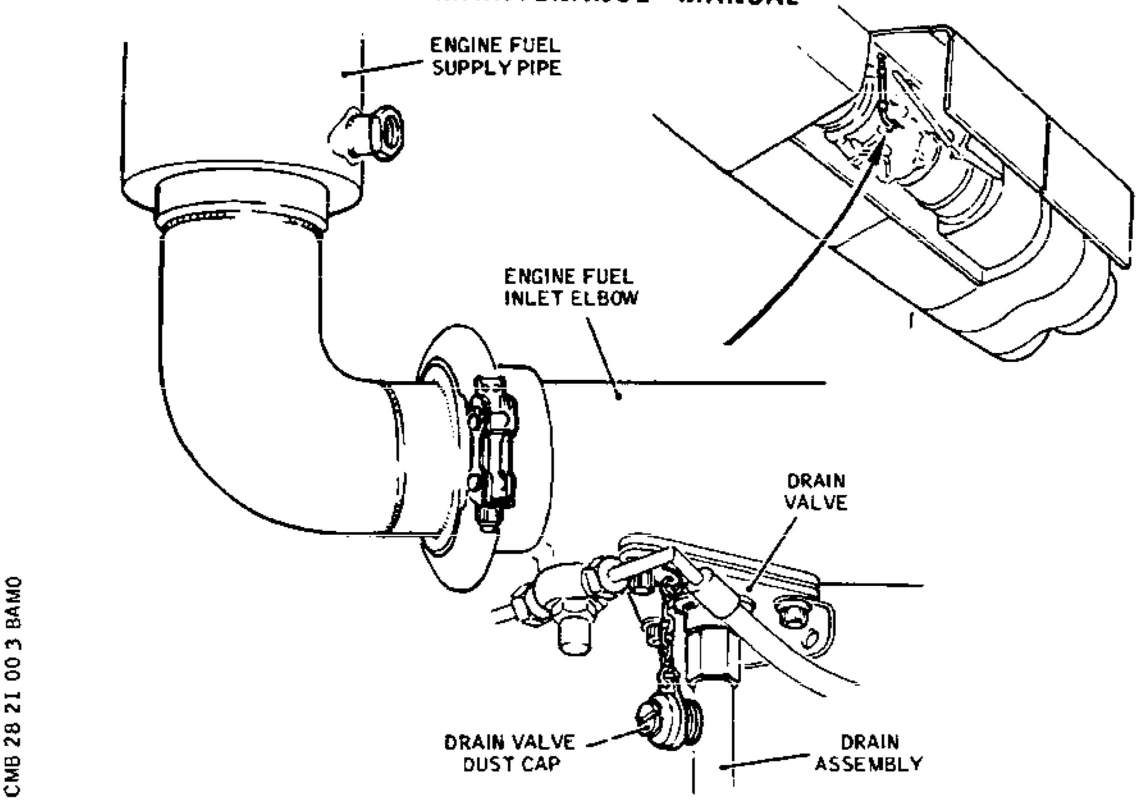
B. Draining Procedure

(1) Open the engine forward lower door (Ref. 71-00-00, Servicing).

(2) Trip the circuit breakers for the associated engine feed pumps (Ref. para.2B).

(3) Remove the centre cover (air bleed) from the top of the accumulator.

(4) Remove the dust cap from the fuel inlet drain valve; insert the hose end of the drain assembly into a receptacle and screw the drain assembly to the drain valve to drain the feed pipe.



Engine Fuel Inlet Drain Valve
Figure 302

(5) At the completion of draining:

(a) Remove the drain assembly and refit the dust cap.

(b) Reset the pump circuit breakers.

(c) Close the engine forward door.

(d) Refit the accumulator air bleed cover.

ENGINE FEED SYSTEM - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic commences with instructions for the removal and installation of minor electrical components, comprising four low pressure valve control relays connected with the engine feed system.

Two relays associated with engines 1 and 2 are mounted in the flight compartment left-hand upper racking on shelf 12-215, and two relays associated with engines 3 and 4 are mounted in the flight compartment right-hand upper racking on shelf 12-216.

The relays are of the plug-in type and are secured to the relay mounting base with nuts and washers.

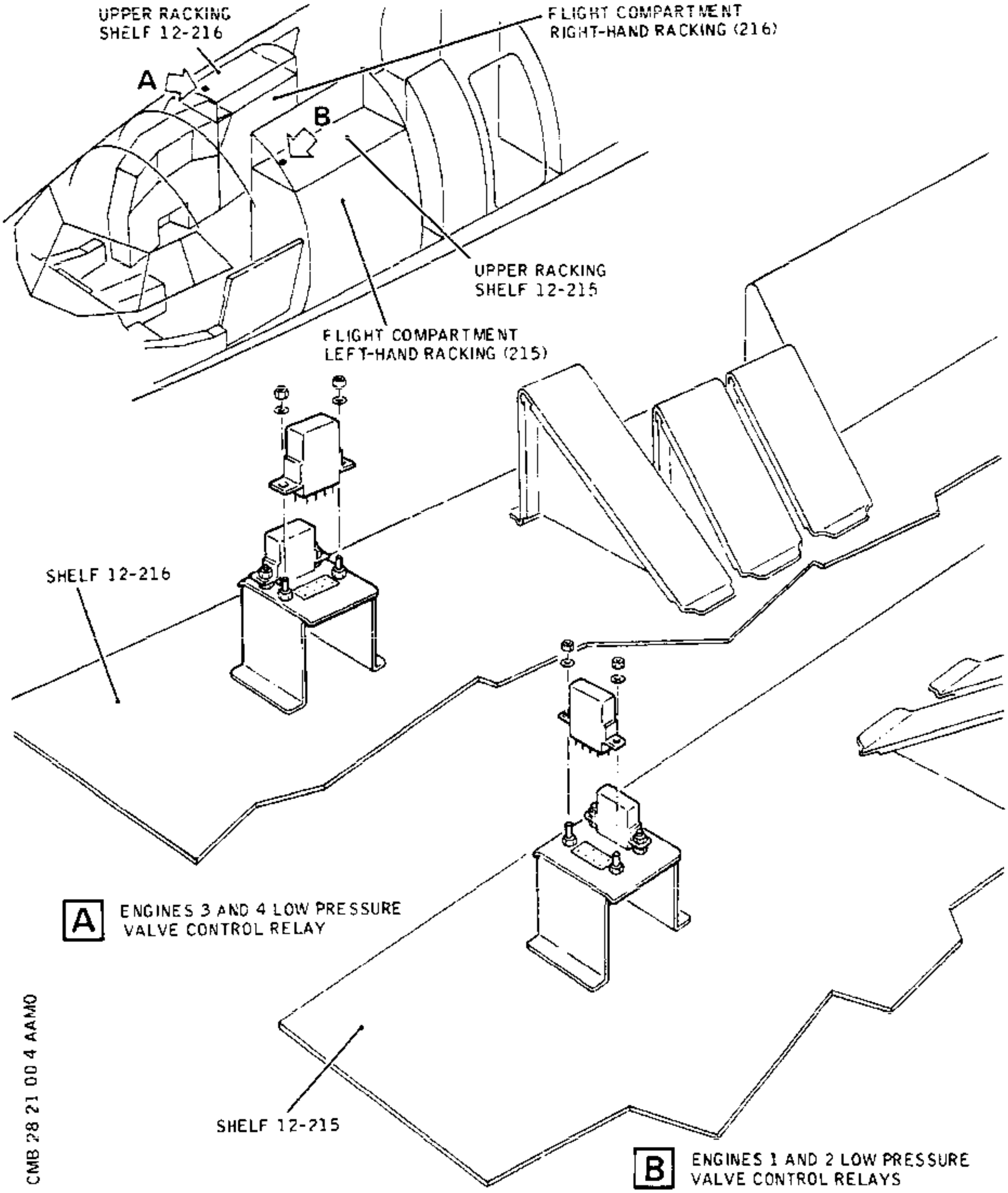
General instructions for removal and installation of other minor electrical components, comprising engine feed control switches, relays, captions, magnetic indicators and diodes, located on the upper and lower fuel panels, refuel panel and in the fuel relay and contactor boxes, are contained in 28-00-00.

This topic also comprises general procedures for the removal and installation of pipe sections in the engine feed system. If removal of a single pipe section is required, the adjoining pipes or equipment may have to be moved sufficiently to effect the operation; in this case the appropriate part of these procedures should be followed.

A gap between pipe ends in the couplings, provided for thermal expansion, facilitates the removal and installation of pipes.

When Gamah couplings (Ref. Fig. 402)are being installed, the general requirements detailed in 20-23-21 and the pipe insertion dimensions (end-float) must be observed.

In the event of damage to the dry lubricant coatings in Gamah couplings, the procedure for the application of dry lubricant must be in accordance with 20-24-35.



R - Low Pressure Valve Control Relays - Installation
Figure 401

2. Low Pressure Valve Control Relay (Ref. Fig. 401)

A. Prepare to Remove Relay

(1) Isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing.

(2) Gain access to the relays in the flight compartment right-hand or left-hand racking upper structure, as applicable, by opening the appropriate circuit breaker panels.

B. Remove Relay

(1) Remove the nuts and washers securing the relay to its mounting base and withdraw the relay from the socket.

C. Install Relay

(1) Comply with the electrical safety precautions.

(2) Align the locating pin on the relay body with the locating hole in the mounting base and plug the relay into the socket.

(3) Secure the relay to the base with the nuts and washers.

D. Conclusion

(1) Close and secure the circuit breaker panels.

(2) Cancel the electrical safety precautions taken in operation A.(1), i.e., remove the warning notices.

(3) Check the operation of the relay by carrying out the appropriate test procedures.

3. System Pipes - in Dry Bays above Engines (Ref. Fig. 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Key, for wing access panel	E920132000
Drain equipment, for engine	D925377000

DESCRIPTION	PART NO.
feed pipeline	
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 and 0.734 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
R Torque spanner, 80 to 89 lbf in (0.904 to 1.006 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Torque spanner, 307 to 317 lbf in (3.469 to 3.582 mdaN)	-
Torque spanner, 445 to 455 lbf in (5.028 to 5.141 mdaN)	-

B. Prepare to Remove Pipes in Dry Bay

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the pipes from the collector tanks fuel supply by closing the LP isolation valves, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) At the fuel management panel, set the LP VALVE switches for the engine feed systems to "SHUT 1". Check that the associated magnetic indicators display bar-across-line.

(3) Isolate the electrical generation and ground power supplies as detailed in 24-00-00, Servicing.

(4) Using the key, unlock and remove the appropriate panels on the wing top surface to gain access to the pipes.

(5) Remove the fire extinguisher bottles (Ref. 26-21-11) to gain access to pipes in the forward bays.

(6) Disconnect electrical connectors, as necessary, to allow freedom of access to pipes.

(7) To contain any debris or loose parts, suitably protect the area below the appropriate pipes.

(8) Cut the locking wire and remove the bleed plug from the recirculation control valve to assist the fuel draining procedure.

(9) Drain the fuel from the engine feed pipelines, using the drain equipment (Ref. 28-21-00, Servicing).

NOTE: A small amount of fuel will remain in the system after draining. When pipes are being disconnected, provision must be made for collecting this fuel in a small container. Spilled fuel must be wiped up immediately.

(10) Refit the bleed plug to the recirculation control valve, using a new O-ring seal, lubricated in accordance with 20-23-11.

(11) Torque-tighten the bleed plug to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock it to the adjacent bolt-head in accordance with 20-21-13.

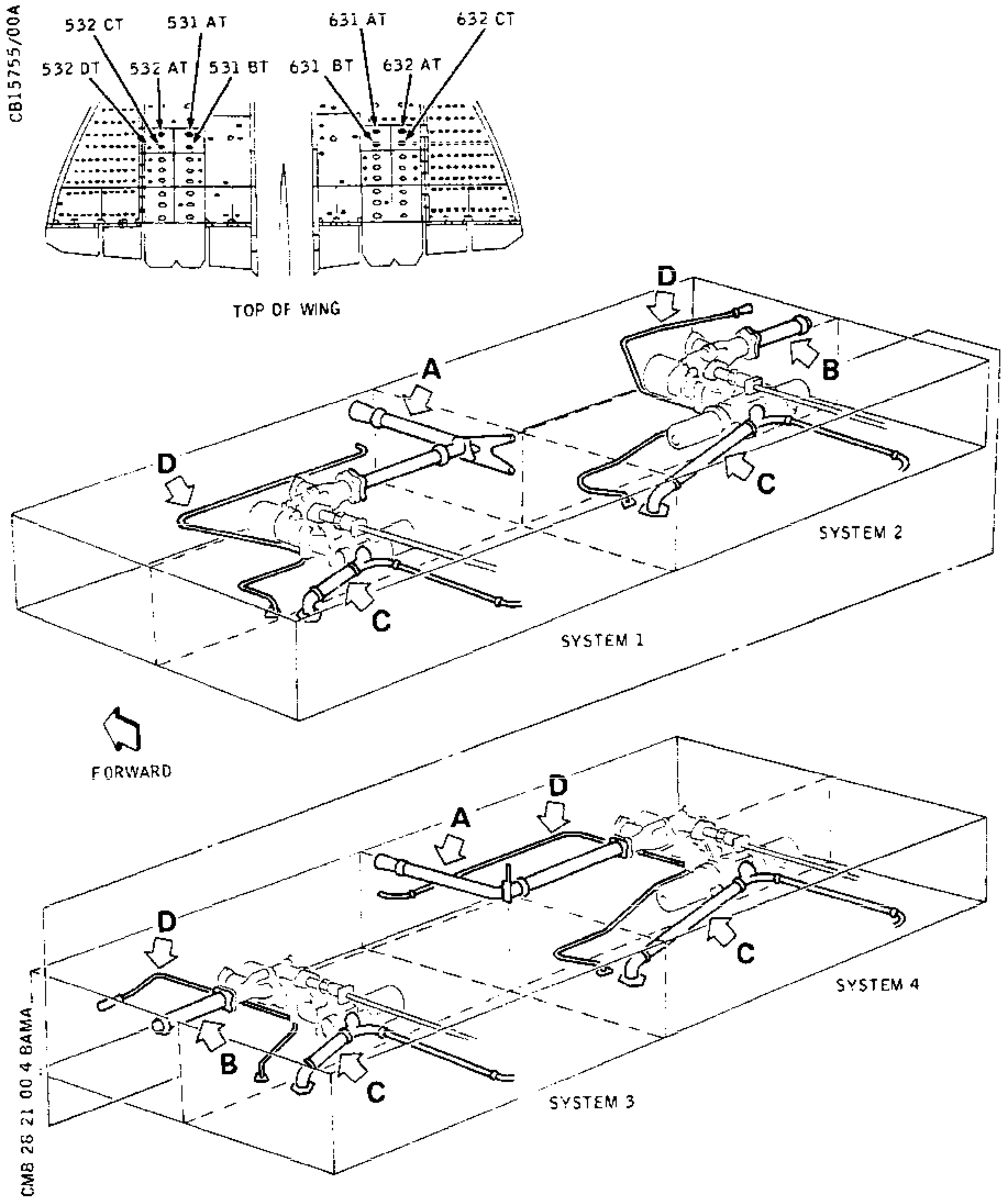
C. Remove Pipes in Dry Bay

(1) Remove the feed pipes (system 1 or 4) between the bulkhead and the bypass valve (Detail A), as follows:-

(a) Remove the bolts and washers securing the bonding leads to the pipe lugs (4 places).

(b) Fully unscrew the coupling nuts at the two Gamah couplings; carefully slide the coupling nuts and snap rings toward the centre of the pipes, ensuring that the protective treatment is not damaged.

(c) Disconnect engine feed pipe (2) from the bypass



\- Pipes and Attachments in Dry Bays -
Installation (Sheet 1 of 4)
Figure 402

R

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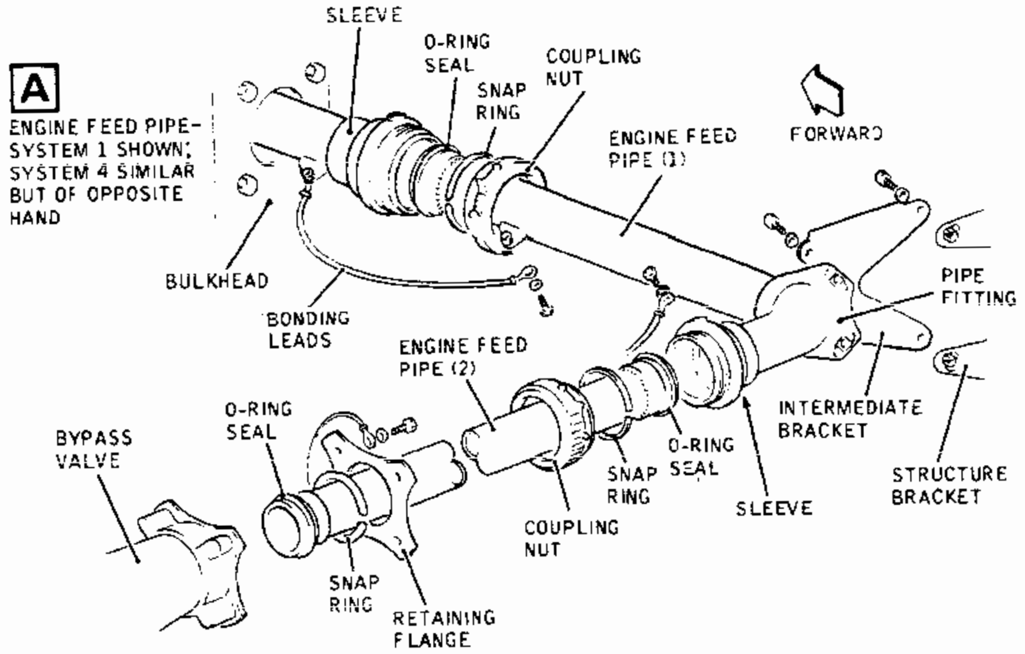

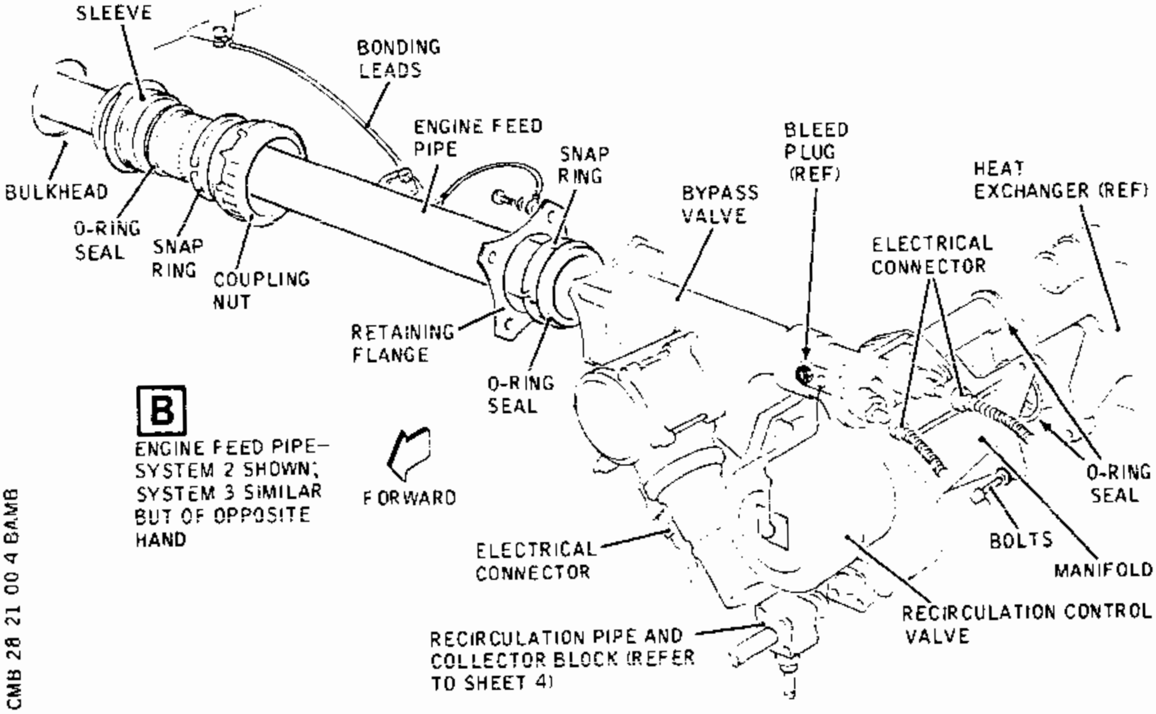

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- Pipes and Attachments in Dry Bays -
Installation (Sheet 2 of 4)
Figure 402

R

valve by removing the four bolts and washers securing the retaining flange and bonding lead; note the position of the bonding bolt. Slide the flange and snap ring clear of the joint.

(d) Support the pipes and remove the four bolts and washers securing the intermediate bracket to the pipe fitting and the structure bracket; remove the intermediate bracket.

NOTE: The upper two bolts are bonding bolts which coincide with prepared surfaces on the intermediate bracket.

(e) Draw the pipes rearward until engine feed pipe (1) is clear of the forward coupling; withdraw engine feed pipe (2) from the bypass valve and separate the two pipes at the Gamah coupling; remove the pipes from the dry bay.

(f) Remove and discard all O-ring seals.

(g) Fit suitable blanks to all open pipe-ends and component apertures.

(2) Remove the feed pipe (system 2 or 3) between the bulkhead and the bypass valve (Detail B), as follows:-

NOTE: To provide sufficient clearance for the removal of this pipe it is necessary to detach the recirculation control valve manifold from the heat exchanger and move the combined recirculation and bypass valves away from the pipe coupling by approximately 0.5 in (12.7 mm).

(a) Remove the bolt and washer securing the bonding leads to the pipe lug.

(b) Fully unscrew the coupling nut at the Gamah coupling; carefully slide the coupling nut and snap ring toward the centre of the pipe, ensuring that the protective treatment is not damaged.

(c) Disconnect the engine feed pipe from the bypass valve by removing the four bolts and washers securing the retaining flange and bonding lead; note the position of the bonding bolt. Slide the flange and snap ring clear of the joint.

(d) Remove the recirculation pipeline collector block, and recirculation pipes, where necessary, as detailed in paragraph (4).

(e) Support the combined recirculation and bypass valves; cut the locking wire and remove the four bolts and washers securing the manifold to the heat exchanger.

(f) Move the combined recirculation and bypass valves away from the pipe coupling by approximately 0.5 in (12.7 mm); remove the engine feed pipe from the dry bay.

(g) Temporarily secure the valves to the heat exchanger by refitting the four bolts and washers.

(h) Remove and discard all O-ring seals.

(i) Fit suitable blanks to all open pipe-ends and component apertures.

(3) Remove the feed pipes between the heat exchanger and the bulkhead connector (Detail C), as follows:-

(a) Disconnect the electrical connector from the temperature sensor on the pipe elbow.

(b) Remove the bolts and washers securing the bonding leads to the pipe lugs (4 places, systems 1 and 3; 5 places, systems 2 and 4).

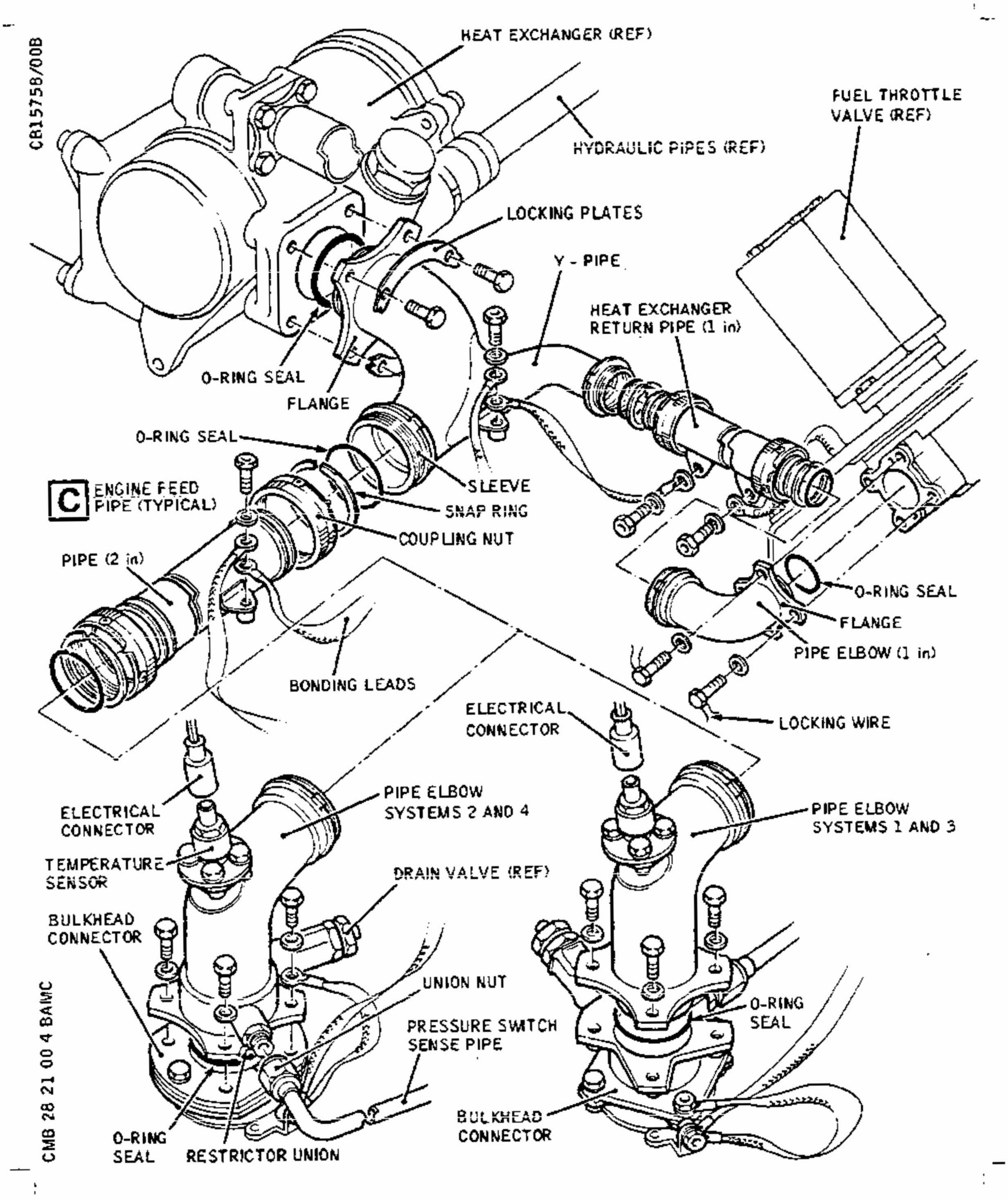
(c) Fully unscrew the coupling nuts at the two Gamah couplings on the heat exchanger return pipe (1 in).

(d) Disconnect the pipe elbow (1 in) from the fuel throttle valve by cutting the locking wire and removing the four bolts and washers securing the flange to the valve.

(e) Remove the pipe elbow (1 in) and heat exchanger return pipe (1 in) from the dry bay.

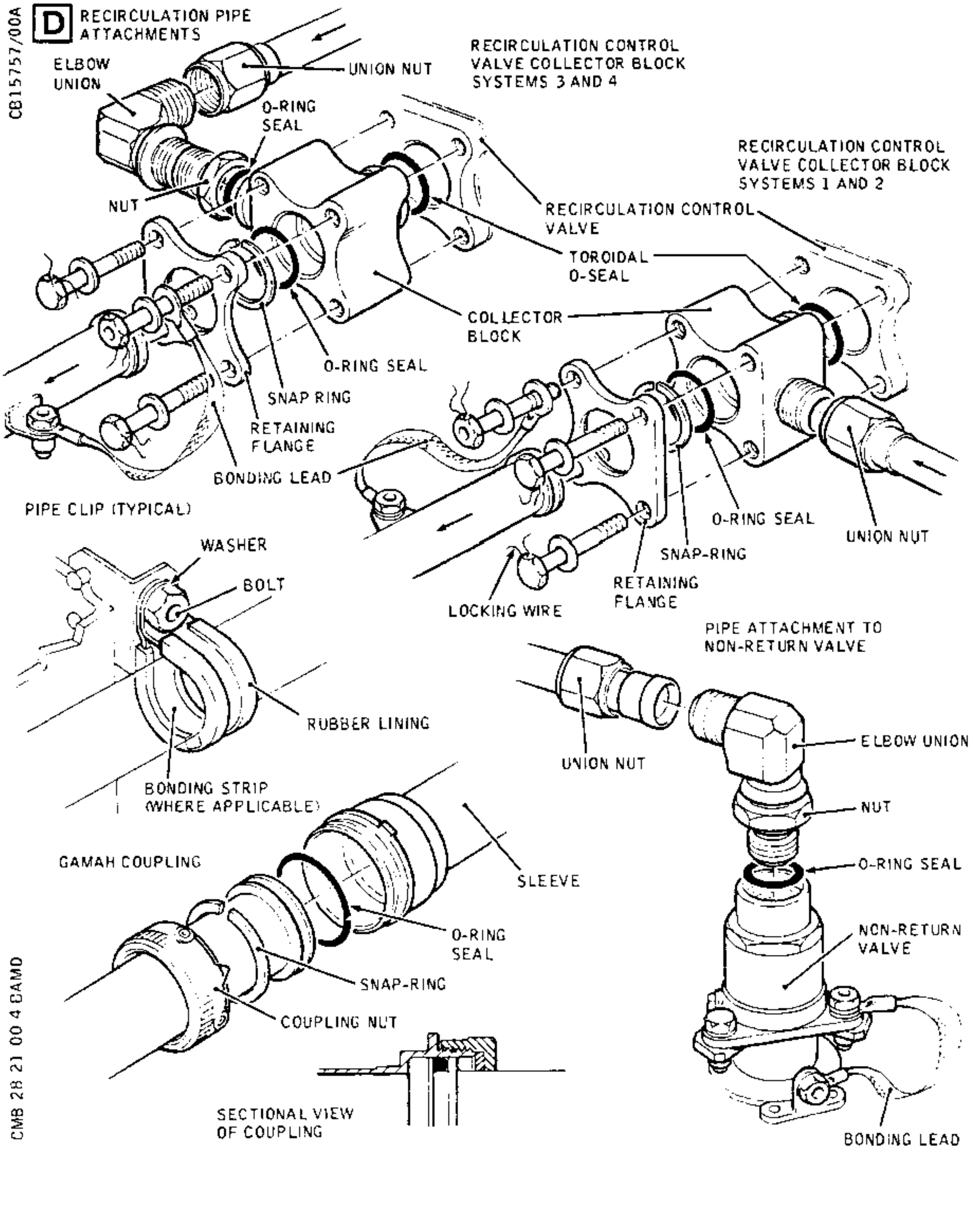
(f) Systems 2 and 4 only: disconnect the pressure switch sense pipe from the pipe elbow.

(g) Disconnect the pipe elbow from the bulkhead connector by removing the four bolts and washers securing the elbow and, in the case of systems



- Pipes and Attachments in Dry Bays -
Installation (Sheet 3 of 4)
Figure 402

R



Pipes and Attachments in Dry Bays - Installation (Sheet 4 of 4)
Figure 402

R

2 and 4, the bonding lead; note the position of the bonding bolt, if applicable.

(h) Disconnect the Y-pipe flange from the heat exchanger by folding back the locking tabs and removing the four bolts and two locking plates.

(i) Remove, as one unit, the Y-pipe, the pipe (2 in) and the pipe elbow from the dry bay.

(j) Fully unscrew the coupling nuts at the two Gamah couplings on the engine feed pipeline and separate the three pipe sections.

(k) Remove and discard all O-ring seals.

(l) Fit suitable blanks to the open ends of all pipes and component apertures.

(4) Remove the recirculation pipes (Detail D), as follows:-

(a) Cut the locking wire and remove the four bolts and washers securing the collector block to the recirculation control valve.

(b) Fully unscrew the coupling nuts at the Gamah couplings near the bulkheads.

(c) Disconnect the pipe at the non-return valve.

(d) Remove the bolts and washers securing the pipe support clips, noting the positions of the clips.

<u>NOTE</u>: During installation, the clips which have bonding strips must be fitted in the positions noted during removal.

(e) Remove the pipes from the dry bay and remove and discard the O-ring seals.

(f) Fit suitable blanks to the open ends of all pipes and component apertures.

D. Prepare to Install Pipes in Dry Bay

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the open pipe-ends and component apertures.

(3) Fit the Gamah coupling components and retaining flanges to the pipes, as detailed in 20-23-21, and lubricate new O-ring seals in accordance with 20-23-11.

E. Install Pipes in Dry Bay

(1) Install the feed pipes (system 1 or 4) between the bulkhead and the bypass valve (Detail A), as follows:-

(a) Insert engine feed pipe (2) into the sleeve of engine feed pipe (1).

(b) Position the pipes in the dry bay, inserting pipe (1) into the sleeve at the bulkhead and pipe (2) into the bypass valve.

(c) Support the pipes and install the intermediate bracket, securing it to the pipe fitting and the structure bracket with the four bolts and washers; ensure that the upper two bolts are bonding bolts and that they coincide with the prepared surfaces on the intermediate bracket.

(d) Torque-tighten the intermediate bracket securing bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(e) Secure the retaining flange to the bypass valve with the four bolts and washers, ensuring that the bonding lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(f) Tighten and lock the coupling nuts at the two Gamah couplings as detailed in 20-23-21.

(g) Secure the bonding leads to the pipe lugs (4 places) with the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(h) Ensure that the electrical bonding of pipes to structure and components is in accordance with 20-27-11.

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(2) Install the feed pipe (system 2 or 3) between the bulkhead and the bypass valve (Detail B), as follows:-

(a) Support the combined recirculation and bypass valves and remove the four bolts and washers securing the manifold to the heat exchanger.

(b) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the recirculation control valve (Ref. 28-21-44, Removal/ Installation).

(c) Position the engine feed pipe in the dry bay, inserting one end into the sleeve at the bulkhead and the other end into the bypass valve.

(d) Secure the manifold to the heat exchanger with the four bolts and washers; torque-tighten
R the bolts to between 80 and 89 lbf in (0.904 and
R 1.006 mdaN) and wire-lock the bolt-heads in pairs in accordance with 20-21-13.

(e) Secure the retaining flange to the bypass valve with the four bolts and washers, ensuring that the bonding lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(f) Tighten and lock the coupling nut of the Gamah coupling as detailed in 20-23-21.

(g) Secure the bonding leads to the pipe lug with the bolt and washer; torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(h) Ensure that the electrical bonding of the pipe to structure and components is in accordance with 20-27-11.

(i) Install the recirculation pipes as detailed in paragraph (4).

(3) Install the feed pipes between the heat exchanger and the bulkhead connector (Detail C), as follows:-

(a) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the pipe at the bulkhead connector (system 2 or 4) or to

the pipe elbow (system 1 or 3).

(b) Secure the pipe elbow to the bulkhead connector with the four bolts and washers, positioning the bonding lead (systems 2 and 4 only) under the bonding bolt; torque-tighten the bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(c) Systems 2 and 4 only: connect the pressure switch sense pipe to the pipe elbow; torque-tighten the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(d) Insert one end of the pipe (2 in) into the Y-pipe sleeve; position both pipes in the dry bay and insert the other end of the pipe (2 in) into the sleeve at the pipe elbow.

(e) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the flanged end of the Y-pipe.

(f) Secure the Y-pipe flange to the heat exchanger with the four bolts and two new locking plates, ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and fold back the locking tabs to lock the bolts.

(g) Tighten and lock the coupling nuts at the two Gamah couplings in accordance with 20-23-21.

(h) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the flanged end of the pipe elbow (1 in).

(i) Insert the heat exchanger return pipe (1 in) into the pipe elbow (1 in) and position both pipes in the dry bay with the return pipe (1 in) inserted into the Y-pipe sleeve.

(j) Secure the flange of the pipe elbow (1 in) to the fuel throttle valve with the four bolts and washers, ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock the bolt-heads in accordance with 20-21-13.

(k) Tighten and lock the coupling nuts at the

two Gamah couplings of the heat exchanger return pipe (1 in) in accordance with 20-23-21.

(l) Fit the electrical connector to the fuel temperature sensor on the pipe elbow, ensuring that the mating surfaces are clean and undamaged.

(m) Secure the bonding leads to the pipe lugs (4 places, systems 1 and 3; 5 places, systems 2 and 4) with the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(n) Ensure that the electrical bonding of the pipes to structure and components is in accordance with 20-27-11.

(4) Install the recirculation pipes (Detail D), as follows:-

(a) Lubricate a new toroidal O-seal in accordance with 20-23-11 and fit it to the recirculation control valve collector block.

(b) To the pipe downstream of the collector block, fit the retaining flange, snap ring and a new O-ring seal, lubricated in accordance with 20-23-11.

(c) Secure the pipe and collector block to the recirculation valve with the four bolts and washers, ensuring that the bonding lead is correctly positioned under the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock the bolt-heads in accordance with 20-21-13.

(d) Secure the other end of the bonding lead to the pipe lug with the bolt and washer; torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(e) Systems 1 and 2: fit the upstream pipe to the collector block and torque-tighten the union nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(f) Systems 3 and 4: fit the nut and a new O-ring seal, lubricated in accordance with 20-23-11, to the elbow union and then fit the elbow union to the collector block; correctly orientate the

union and lock it with the nut as shown in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'; torque-tighten the nut to between 307 and 317 lbf in (3.469 and 3.582 mdaN). Fit the upstream pipe to the elbow union and torque-tighten the union nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(g) Tighten and lock the coupling nuts at the Gamah couplings in accordance with 20-23-21.

(h) Fit the nut and a new O-ring seal, lubricated in accordance with 20-23-11, to the elbow union which attaches the pipe to the non-return valve.

(i) Fit the elbow union and nut to the valve; correctly orientate the union and lock it with the nut as shown in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'; torque-tighten the nut to between 445 and 455 lbf in (5.028 and 5.141 mdaN).

(j) Connect the recirculation pipe to the elbow union; torque-tighten the union nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(k) Refit, with the bolts and washers, the pipe clips to the recirculation pipe, ensuring that the clips with bonding strips are in the positions noted during removal; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(l) Where applicable, check that the electrical bonding of the pipe to the clip and structure, and component to structure, is in accordance with 20-27-11.

F. Conclusion

(1) Ensure that all tools, equipment etc., have been removed from the dry bays and remove the debris containment protection.

(2) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Set the LP VALVE switch to "OPEN".

(5) If applicable, carry out a check for satisfactory operation of the bypass valve motor, including freedom from leakage, as detailed in 28-21-41, Removal/Installation.

(6) Carry out a Leakage Test of the disturbed pipes (Ref. Adjustment/Test).

(7) Check the electrical connections, if disturbed, as follows:-

(a) Carry out an Operational Test of the feed pipe fuel temperature sensors (Ref. 28-45-00, Adjustment/Test).

(b) Carry out a Functional Test of the heat exchanger fuel temperature sensor (Ref. 21-13-12).

(8) Refit the fire extinguisher bottles (Ref. 26-21-11).

(9) Refit the access panels and lock them, using the key.

(10) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. System Pipes - in Tanks 2 and 3 (Ref. Fig. 403)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

NOTE: The arrangement of the pipes in tank 3 is similar, but of opposite hand, to that in tank 2. The following procedures are applicable to both tanks; the unbracketed numbers refer to tank 2 installation, and the bracketed numbers refer to tank 3 installation. For the purpose of reference within this topic, the main feed pipes are numbered from 1 to 14, and the cross-feed pipes are numbered from C1 to C3.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 49 lbf in	-

DESCRIPTION	PART NO.
(0.452 to 0.554 mdaN)	
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 75 to 125 lbf in (0.847 to 1.412 mdaN)	-
Suitable suction equipment to collect spilled fuel	-
Rubber-backed mats, to protect tank floor and wing top surface	-
Key, for dry bay access panel	E920132000

B. Prepare to Remove Pipes in Tank 2 or 3

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the pipes from the dry bays by closing the LP isolation valves as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) At the fuel management panel, set the LP VALVE switch for system 2 (3) to "SHUT 1". Check that the associated magnetic indicator displays bar-across-line.

(3) Defuel and drain tank 2 (3) and the adjacent main transfer tank(s) 6 (6 and 7) (Ref. 28-25-00, Servicing).

(4) Isolate the electrical generation and ground power

supplies as detailed in 24-00-00, Servicing.

(5) Remove the appropriate panels (Ref. Fig. 403) as detailed in 53-00-00 and 57-00-00, Removal/Installation, to gain access to the tanks and dry bays.

(6) Prepare the tanks for entry as detailed in 28-10-00, Servicing.

(7) Remove the removable tank bracing struts (Ref. 57-15-10, Removal/Installation), as required, to gain access to the pipes.

(8) Remove the fuel quantity probes (Ref. 28-44-**, Removal/Installation), as required, to gain access to the pipes.

** As appropriate.

C. Remove Pipes in Tank 2 or 3

NOTE: When the pipes are disconnected, the fuel trapped in the pipelines will be spilled. The pipe couplings must therefore be disconnected slowly and spilled fuel must be collected immediately, preferably by means of suitable suction equipment.

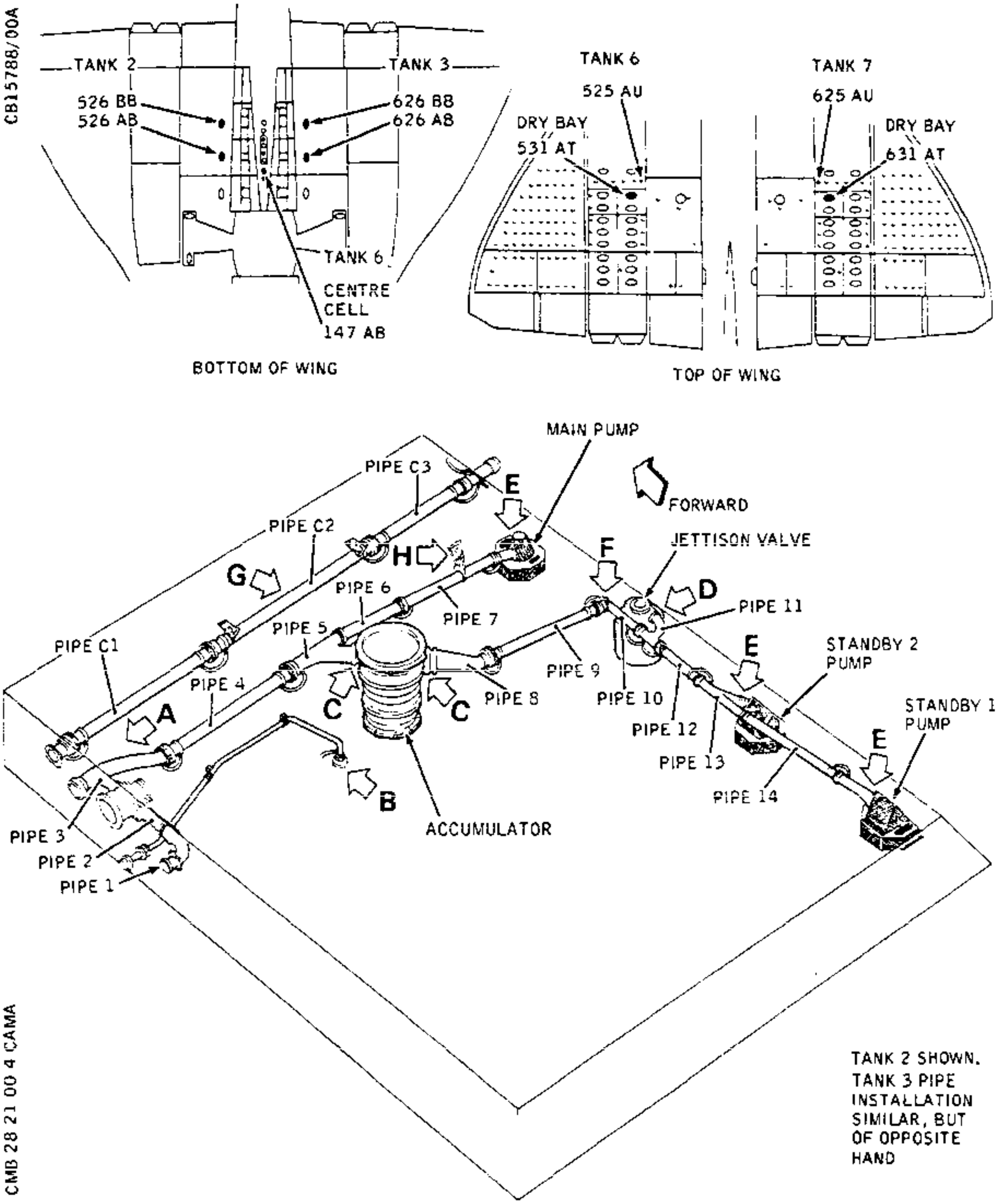
(1) Remove feed pipes 1 to 5, between the tank bulkhead (Detail A) and the accumulator outlet (Detail C), as follows:-

(a) From within the dry bay (Ref. para.3.), fully unscrew the pipe 1 Gamah coupling nut near the bulkhead. Remove the four bolts and washers securing the pipe 1 flange to the bulkhead.

(b) From within tank 6 (7), remove the four bolts and washers securing pipe 3 flange to the bulkhead.

(c) Enter tank 2 (3) and disconnect the bonding leads from the lugs and clips on pipes 1 to 5. Note the positions of the bonding lead attachments.

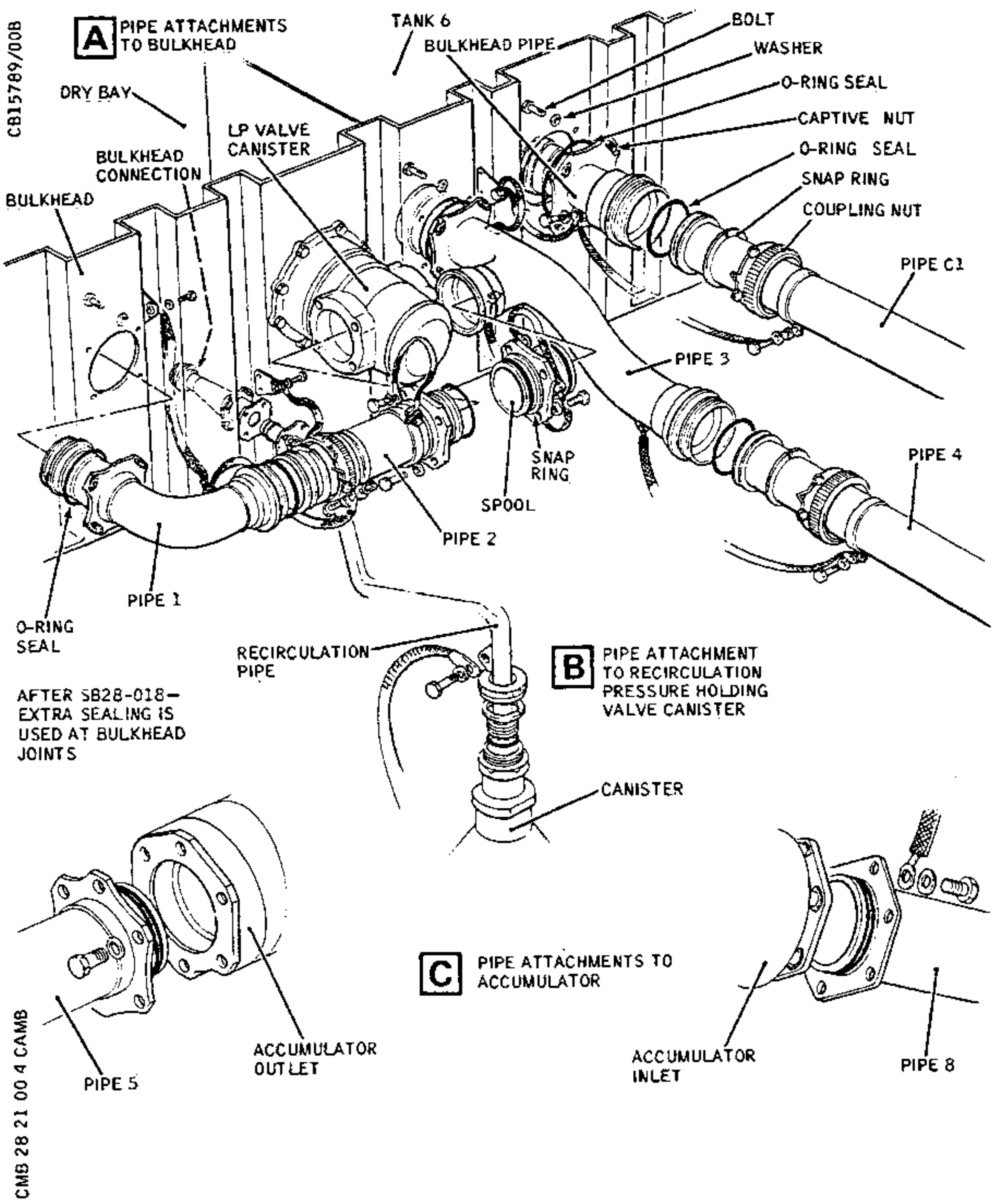
(d) Disconnect the pipes on each side of the LP valve canister by removing the bolts and



- Pipes and Attachments in Tanks 2 and 3 -
Installation (Sheet 1 of 3)
Figure 403

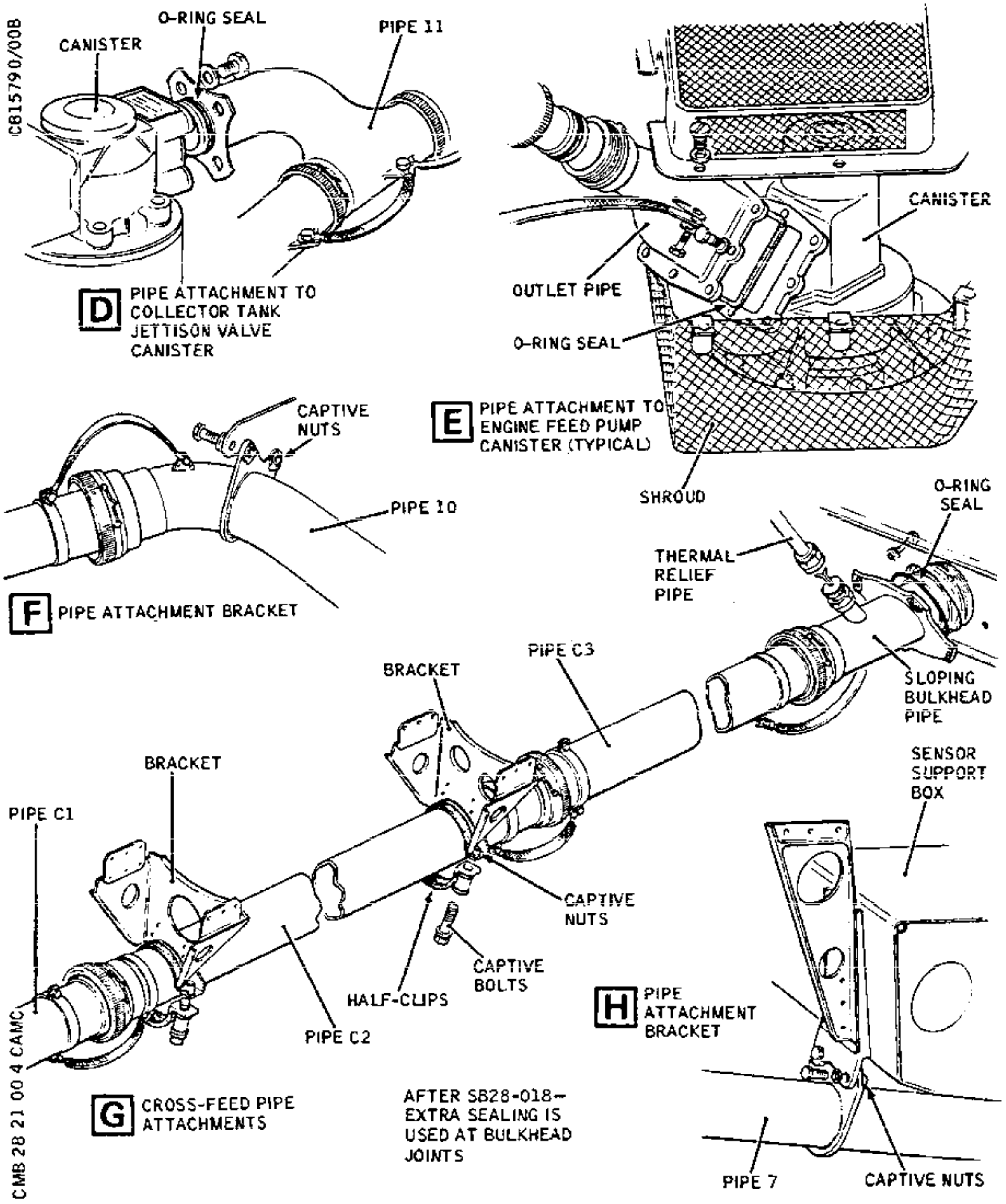
R

EFFECTIVITY: ALL



- Pipes and Attachments in Tanks 2 and 3 -
Installation (Sheet 2 of 3)
Figure 403

R



- Pipes and Attachments in Tanks 2 and 3 -
Installation (Sheet 3 of 3)
Figure 403

R

washers; note the positions of the bonding bolts.

(e) Fully unscrew the Gamah coupling nuts of pipes 1 to 5 (4 places); slide the coupling nuts and snap rings carefully toward the centre of each pipe, ensuring that the protective treatment is not damaged.

(f) Disconnect pipe 5 from the accumulator by removing the six bolts and washers (Detail C).

(g) Disengage pipe 5 from the accumulator.

(h) Move pipes 4 and 5 inboard, toward the main feed pump, and then move the outboard end of pipe 4 sideward the minimum amount, without straining it, until it is clear of the pipe 3 sleeve; carefully ease pipe 4 toward the tank bulkhead and remove it, together with pipe 5.

R NOTE: If difficulty is encountered in removing
R pipes 1 and 2, remove the LP isolation
R valve canister in accordance with 28-21-43.

(i) Disengage pipe 3 from the spool.

Before 28-018

(j) Remove pipe 3 from the tank bulkhead and remove the spool from the LP valve canister.

After SB 28-018 For A/C 001-005,

(j) Remove sealants from the bulkhead joint (Ref. para.8.). Remove pipe 3 from the tank bulkhead and remove the spool from the LP valve canister.

Before SB 28-018

(k) Disengage pipe 1 from pipe 2; remove pipe 1 from the tank bulkhead and remove pipe 2 from the LP valve canister.

After SB 28-018 For A/C 001-005,

(k) Disengage pipe 1 from pipe 2; remove sealants from the bulkhead joint (Ref. para.8.); remove pipe 1 from the tank bulkhead and remove pipe 2

R from the LP valve canister.

(l) Remove and discard all O-ring seals.

(m) Remove the Gamah coupling components and retaining flanges from the pipes.

(n) Remove the bonding clips from the pipes.

(o) Fit suitable blanks to the open ends of all pipes and component apertures.

(2) Remove feed pipes 6 and 7, between the accumulator and the main feed pump (Detail E), as follows:-

(a) Enter tank 2 (3) and disconnect the bonding leads from the lugs and clips on the pipes; note the positions of the bonding lead attachments.

(b) Remove the two bolts and washers securing the pipe 7 fitting to the bracket on the sensor support box (Detail H); note the position of the bonding bolt.

(c) Remove the top section of the shroud covering the main pump canister (Detail E).

(d) Disconnect the outlet pipe from the canister by removing the eight bolts and washers.

(e) Fully unscrew the Gamah coupling nuts of pipes 6 and 7 (2 places); slide the coupling nuts and snap rings toward the centre of each pipe, ensuring that the protective treatment is not damaged.

(f) Move pipes 6 and 7 outward, away from the pump canister, and disengage the outlet pipe from the canister.

(g) Remove the outlet pipe from pipe 7 and then remove pipes 6 and 7.

(h) Remove and discard all O-ring seals.

(i) Remove the Gamah coupling components from the pipes.

(j) Remove the bonding clips from the pipes.

(k) Fit suitable blanks to the open ends of all pipes and component apertures.

(l) Temporarily refit the top section of the shroud covering the main pump canister.

(3) Remove feed pipes pipes 8 to 14, between the accumulator inlet (Detail C) and the jettison valve (Detail D) and standby pump canisters (Detail E), as follows:-

(a) Enter tank 2 (3) and disconnect the bonding leads from the lugs and clips on the pipes; note the positions of the bonding lead attachments.

(b) Remove the two bolts and washers securing the pipe 10 fitting to the bracket (Detail F); note the position of the bonding bolt.

(c) Disconnect pipe 8 from the accumulator by removing the six bolts and washers (Detail C).

(d) Fully unscrew the Gamah coupling nuts of pipes 8 and 9 (2 places); disengage pipe 8 from the accumulator and remove pipes 8 and 9.

(e) Disconnect pipe 11 from the jettison valve canister (Detail D) by removing the four bolts and washers; note the position of the bonding bolt.

(f) Remove the top sections of the shrouds covering the standby pump canisters (Detail E).

(g) Disconnect pipe 13 from the standby 2 pump canister (Detail E) by removing the eight bolts and washers.

(h) Disconnect the outlet pipe from the standby 1 pump canister (Detail E) by removing the eight bolts and washers.

(i) Fully unscrew the Gamah coupling nuts of pipes 10 to 14 (5 places); slide the coupling nuts and snap rings carefully toward the centre of each pipe, ensuring that the protective treatment is not damaged; remove pipe 10.

(j) Disengage pipe 11 from the jettison valve canister; remove pipes 11 and 12.

(k) Disengage pipe 13 from the standby 2 pump canister; remove pipes 13 and 14.

(l) Disengage the outlet pipe from the standby 1 pump canister; remove the outlet pipe.

(m) Remove and discard all O-ring seals.

(n) Remove the Gamah coupling components from the pipes.

(o) Remove the bonding clips from the pipes.

(p) Fit suitable blanks to the open ends of all pipes and component apertures.

(q) Temporarily refit the top sections of the shrouds covering the standby pump canisters.

(4) Remove cross-feed pipes C1 to C3 (Details A and G), as follows:-

(a) Enter tank 2 (3) and disconnect the bonding leads from the clips and lugs on the pipes.

(b) Release the captive bolts securing the half-clips to the brackets (2 places).

(c) Fully unscrew the Gamah coupling nuts of pipes C1, C2 and C3 (4 places); carefully slide the nuts and snap rings toward the centre of each pipe, ensuring that the protective treatment is not damaged.

(d) Moves pipes C1, C2 and C3 inboard, toward the tank sloping bulkhead, and carefully move pipe C1 sideward, the minimum amount, until it is clear of the bulkhead pipe sleeve; remove pipes C1, C2 and C3.

(e) From within tank 6 (7), remove the four bolts and washers securing the bulkhead pipe to the tank bulkhead (Detail A).

R Before SB 28-018

(f) From within tank 2 (3), remove the bulkhead pipe from the tank bulkhead.

R After SB 28-018 For A/C 001-005,

R (f) From within tank 2 (3), remove sealants from
R the pipe joint (Ref. para.8.) and remove
R the bulkhead pipe from the tank bulkhead.

(g) Remove the sloping bulkhead pipe (Detail G), as follows:-

g1) From within tank 6 centre cell, remove the four bolts and washers securing the pipe flange to the tank sloping bulkhead.

R Before SB 28-018

g2) From within tank 2 (3), disconnect the thermal relief pipe and then remove the pipe from the tank sloping bulkhead.

R After SB 28-018 For A/C 001-005,

R g2) From within tank 2 (3), disconnect the
R thermal relief pipe. Remove sealants from
R the bulkhead joint (Ref. para.8.) and remove
R the sloping bulkhead pipe.

(h) Remove and discard all O-ring seals.

(i) Remove the Gamah coupling components from the pipes.

(j) Remove the bonding clips from the pipes.

(k) Fit suitable blanks to the open ends of all pipes.

(5) Remove the recirculation pipe as follows:-

(a) From within tank 2 (3), remove the bolts and washers securing the bonding leads to the pipe lugs (2 places).

(b) Remove the bolts and washers securing the pipe support clips (2 places); remove the clips.

(c) Remove the four bolts and washers securing

the bolted flange and the pipe to the bulkhead connection (Detail A).

(d) Fully unscrew the coupling nut securing the the pipe to the recirculation pressure holding valve canister (Detail B); remove the pipe.

(e) Remove and discard the O-ring seals at each end of the pipe.

(f) Remove the Gamah coupling components from the pipe.

(g) Fit suitable blanks to the open ends of the pipes and the canister aperture.

D. Prepare to Install Pipes in Tank 2 or 3

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) If applicable, remove the top sections of the shrouds covering the pump canisters.

(3) Remove the blanks from the open pipe-ends and component apertures.

(4) Before installation, ensure that all joint surfaces are clean and undamaged.

(5) Fit the bonding clips to the pipes in the positions noted during removal.

(6) Fit the Gamah coupling components and, where applicable, the retaining flanges to the pipes, as detailed in 20-23-21.

(7) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the Gamah couplings.

E. Install Pipes in Tank 2 or 3

R NOTE: If the LP isolation valve canister was removed
R in procedure C: during the installation of
R pipes 1 to 3, refit the canister in accordance
R with 28-21-43.

(1) Install feed pipes 1 to 5, between the tank bulkhead (Detail A) and the accumulator outlet (Detail C), as follows:-

Before SB 28-018

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on pipe 1.

After SB 28-018 For A/C 001-005,

(a) Apply sealants to the flange on pipe 1 (Ref. para.8.).

(b) Insert pipe 2 into the pipe 1 sleeve and position both pipes in tank 2 (3).

(c) From within the dry bay, secure pipe 1 to the tank bulkhead with the bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(d) Tighten and lock the Gamah coupling nut at the pipe 1 coupling in the dry bay, in accordance with 20-23-21.

(e) Within tank 2 (3), tighten and lock the Gamah coupling nut at the coupling between pipes 1 and 2, in accordance with 20-23-21.

(f) Secure the retaining flange of pipe 2 to the LP valve canister with the four bolts and washers, first ensuring that the bonding lead and bolt are correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

Before SB 28-018

(g) Lubricate new O-ring seals in accordance with 20-23-11, and fit them to the spool and to the flange on pipe 3.

After SB 28-018 For A/C 001-005,

(g) Lubricate new O-ring seals in accordance with 20-23-11, and fit them to the spool. Apply sealants to the flange on pipe 3 (Ref. para.8.).

(h) Insert the spool into the pipe 3 sleeve and position both pipes in tank 2 (3).

(i) From within tank 6 (7), secure pipe 3 to the tank bulkhead with the four bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(j) Secure the retaining flange of the spool to the LP valve canister with the four bolts and washers, first ensuring that the bonding lead and bolt are correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(k) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on pipe 5 (Detail C).

(l) Position pipes 4 and 5 in the tank and secure pipe 5 to the accumulator with the six bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 70 and 80 lbf in (0.802 and 0.904 mdaN).

(m) Tighten and lock the Gamah coupling nuts of pipes 4 and 5, in accordance with 20-23-21.

(n) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(2) Install feed pipes 6 and 7, between the accumulator and the main feed pump (Detail E), as follows:-

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the pump outlet pipe.

(b) Position pipes 6 and 7, and the outlet pipe, in the tank; attach the outlet pipe to the main pump canister with the eight bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(c) Tighten and lock the Gamah coupling nuts of pipes 6 and 7 (3 places), in accordance with 20-23-21; check that the pipe end-float is correct.

(d) Secure pipe 6 to the bracket on the sensor support box (Detail H) with the two bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten

the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(e) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(3) Install feed pipes 8 to 14, between the accumulator inlet (Detail C) and the standby pump canisters (Detail E), as follows:-

(a) Secure pipe 8 to the accumulator with the six bolts and washers, first ensuring that the bonding bolt and lead are correctly positioned; torque-tighten the bolts to between 70 and 80 lbf in (0.802 and 0.904 mdaN).

(b) Position pipes 9 and 10 in the tank; secure pipe 10 to the bracket (Detail F) with the two bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(c) Tighten and lock the Gamah coupling nuts of pipes 8 and 9 (2 places) in accordance with 20-23-21.

(d) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the attachment flange on pipe 11 (Detail D); position pipe 11 and secure the flange to the jettison valve canister with the four bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(e) Lubricate new O-ring seals in accordance with 20-23-11, and fit them to the attachment flanges on pipe 13 and the standby 1 pump outlet pipe.

(f) Position pipes 12, 13, 14 and the pump outlet pipe in the tank.

(g) Secure the attachment flanges to the standby 2 and standby 1 pump canisters, each with

six bolts and washers, first ensuring that the bonding bolts are correctly positioned; torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(h) Tighten and lock the Gamah coupling nuts of pipes 11, 12, 13 and 14 (5 places), in accordance with 20-23-21.

(i) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(4) Install cross-feed pipes C1 to C3 (Detail G), as follows:-

R Before SB 28-018

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the bulkhead pipe (Detail A).

R After SB 28-018 For A/C 001-005,

R (a) Apply sealants to the flange on the bulkhead
R pipe (Detail A) (Ref. para.8.).

(b) Position the bulkhead pipe in tank 2 (3), and, from within tank 6 (7), secure the pipe flange to the tank bulkhead with the four bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

R Before SB 28-018

(c) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the sloping bulkhead pipe (Detail G).

R After SB 28-018 For A/C 001-005,

R (c) Apply sealants to the flange on the sloping
R bulkhead pipe (Detail G) (Ref. para.8.).

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(d) Position the sloping bulkhead pipe in tank 2 (3), and, from within tank 6 centre cell, secure the pipe flange to the tank sloping bulkhead with the four bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(e) Position pipes C1, C2 and C3 in the tank and secure pipe C2 to the structure brackets with the half-clips and bolts (Detail G); only hand-tighten the bolts at this stage.

(f) Tighten and lock the Gamah coupling nuts (4 places) in accordance 20-23-21.

(g) Check that the end-float at each coupling is in accordance with 20-23-21 and then torque-tighten the bolts, securing the half-clips, to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(h) Connect the thermal relief pipe to the union on the sloping bulkhead pipe; torque-tighten the union nut to between 75 and 125 lbf in (0.847 and 1.412 mdaN).

(i) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(5) Install the recirculation pipe (Detail A), as follows:-

R (a) Lubricate two new O-ring seals in accordance
R with 20-23-11, and fit one to each end of the
R recirculation pipe.

R (b) From within tank 2 (3), secure the retaining
R flange to the bulkhead connection with the four
R bolts and washers (Detail A); torque-tighten
the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

R (c) Tighten and lock, in accordance with 20-23-21, the Gamah coupling nut at the pipe connection to the pressure holding valve canister (Detail B).

R (d) Secure the pipe to the structure with the pipe support clips, bolts and washers

(2 places). Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

F. Conclusion

(1) Refit, as necessary, the top sections of the shrouds covering the engine feed pump canisters.

(2) Check that all electrical bonding between the disturbed pipes, components and structure is in accordance with 20-27-11.

(3) Refit the tank bracing struts (Ref. 57-15-10, Removal/Installation).

(4) Refit the fuel quantity probes (Ref. 28-44-**, Removal/Installation).

** As appropriate.

(5) Ensure that all tools, equipment etc., have been removed from the tanks and dry bays.

(6) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(7) Make available electrical ground power as detailed in 24-41-00.

(8) Set the LP VALVE switch to "OPEN" and check that the associated magnetic indicator displays bar-in-line.

(9) Carry out a Leakage Test of the disturbed pipes (Ref. Adjustment/Test).

R (10) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (11) Refit the tank access panels (Ref. 53-00-00 and 57-00-00, Removal/Installation.)

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R (12) Refit the dry bay access panels and lock them, using the key.

R (13) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. System Pipes - in Tanks 1 and 4 (Ref. Fig. 403 and 404)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

NOTE: The arrangement of the pipes in tank 4 is similar, but of opposite hand, to that in tank 1. The following procedures are applicable to both tanks, the unbracketed numbers refer to tank 1 installation, and the bracketed numbers refer to tank 4 installation. For the purpose of reference within this topic, the main feed pipes are numbered from 1 to 15, and the recirculation pipes are numbered R1 and R2.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.802 to 0.904 mdaN)	-
Suitable suction equipment, to collect spilled fuel	-
Rubber-backed mats, to protect tank floor and wing top surface	-

B. Prepare to Remove Pipes in Tank 1 or 4

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

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(2) Defuel and drain tank 1 (4) and the adjacent main transfer tank 5 (8) (Ref. 28-25-00, Servicing).

(3) Isolate the electrical generation and ground power supplies as detailed in 24-00-00, Servicing.

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(4) Remove the appropriate panels (Ref. Fig. 404) as detailed in 57-00-00, Removal/Installation, to gain access to the tanks.

(5) Prepare tank 1 (4) for entry as detailed in 28-10-00, Servicing.

(6) Remove the removable tank bracing struts (Ref. 57-15-10, Removal/Installation), as required, to gain access to the pipes.

(7) Remove the fuel quantity probes (Ref. 28-44-**, Removal/Installation), as required, to gain access to the pipes.

** As appropriate.

C. Remove Pipes in Tank 1 or 4

<u>NOTE</u>: When the pipes are disconnected, the fuel trapped in the pipelines will be spilled. The pipe couplings must therefore be disconnected slowly and spilled fuel must be collected immediately, preferably by means of suitable suction equipment.

(1) Remove feed pipes 1 to 3, between the tank bulkhead (Detail A) and the bulkhead within the tank (Detail B), as follows:-

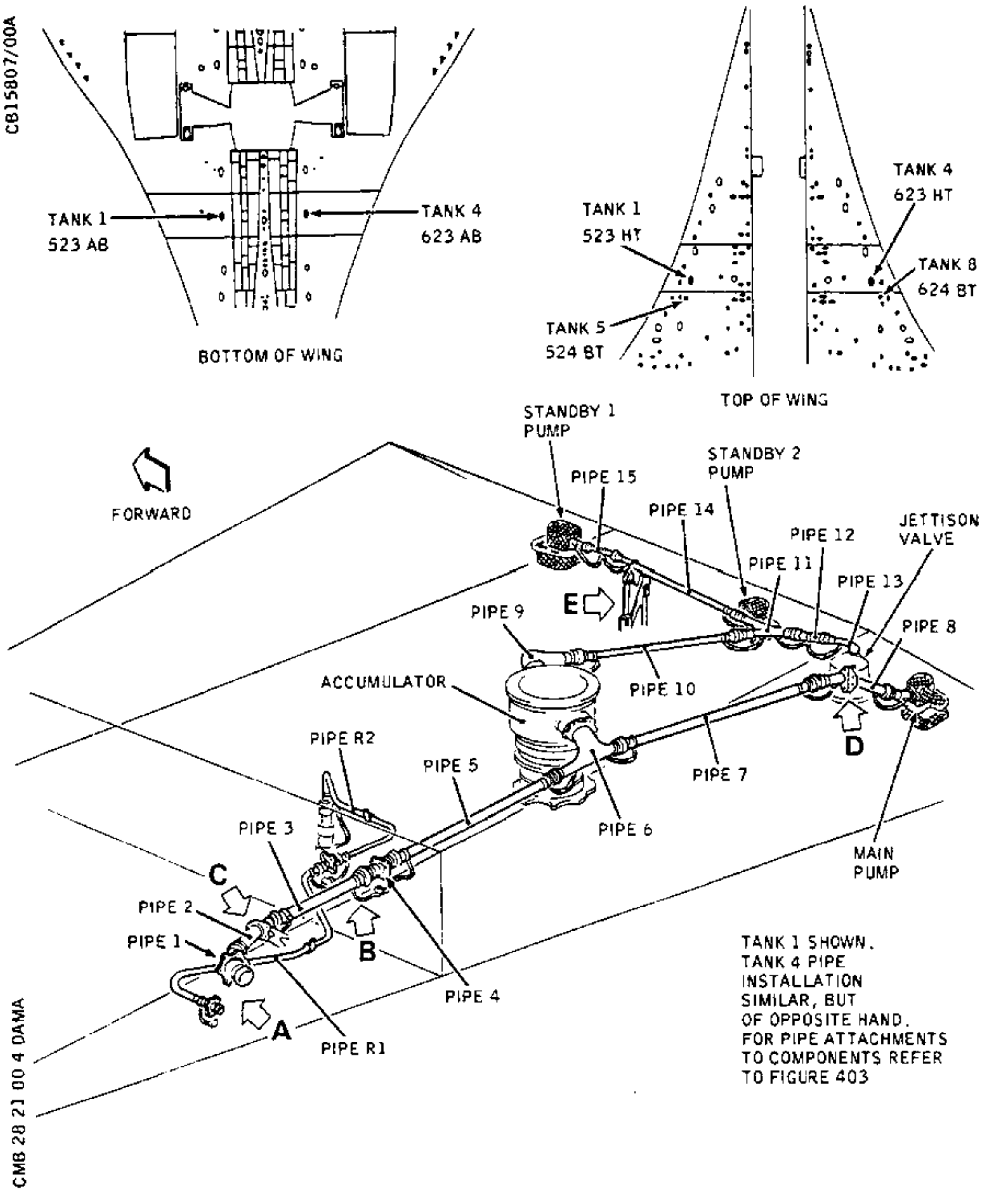
(a) From within tank 5 (8), remove the six bolts and washers securing the pipe 1 flange to the bulkhead; fully unscrew the Gamah coupling nut near the bulkhead.

(b) From within tank 1 (4), remove the two bolts and washers securing the pipe 2 fitting to the intermediate bracket (Detail C).

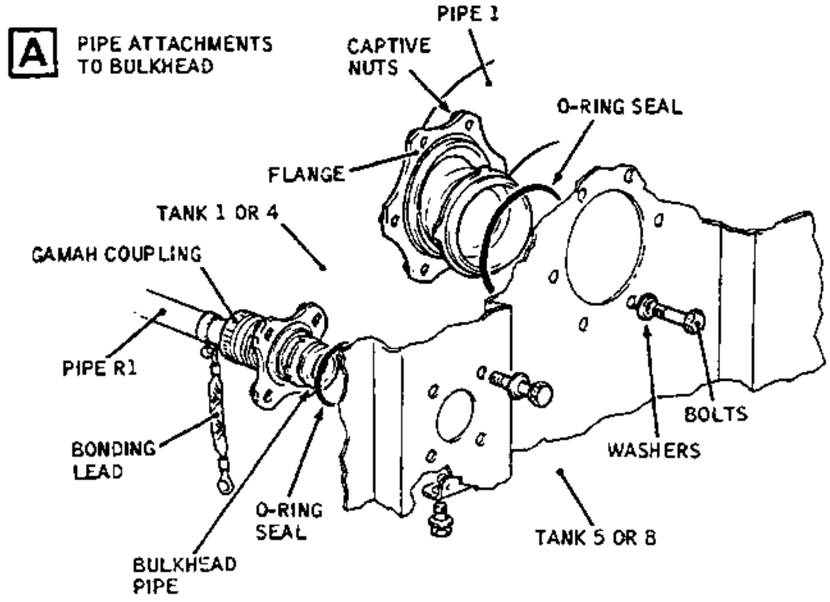
(c) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

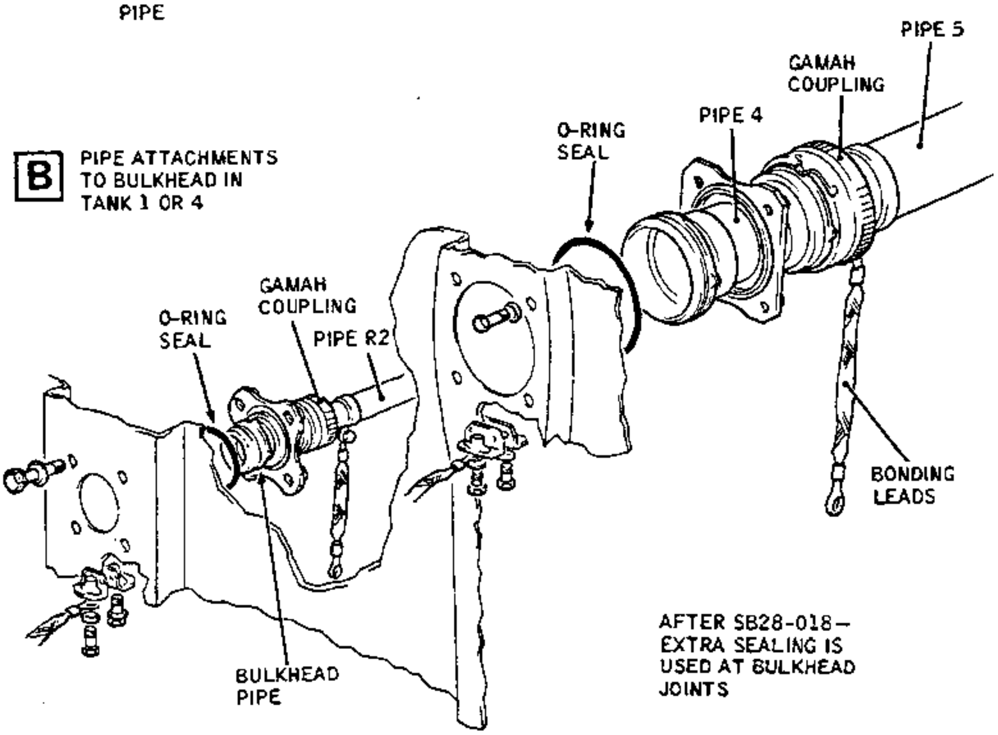
(d) Fully unscrew the Gamah coupling nuts (3 places); slide the nuts and snap rings toward the centre of each pipe, ensuring that the protective surface is not damaged.

R Before SB 28-018



- Pipes and Attachments in Tanks 1 and 4 -
Installation (Sheet 1 of 3)
Figure 404





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\- Pipes and Attachments in Tanks 1 and 4 -
Installation (Sheet 2 of 3)
Figure 404

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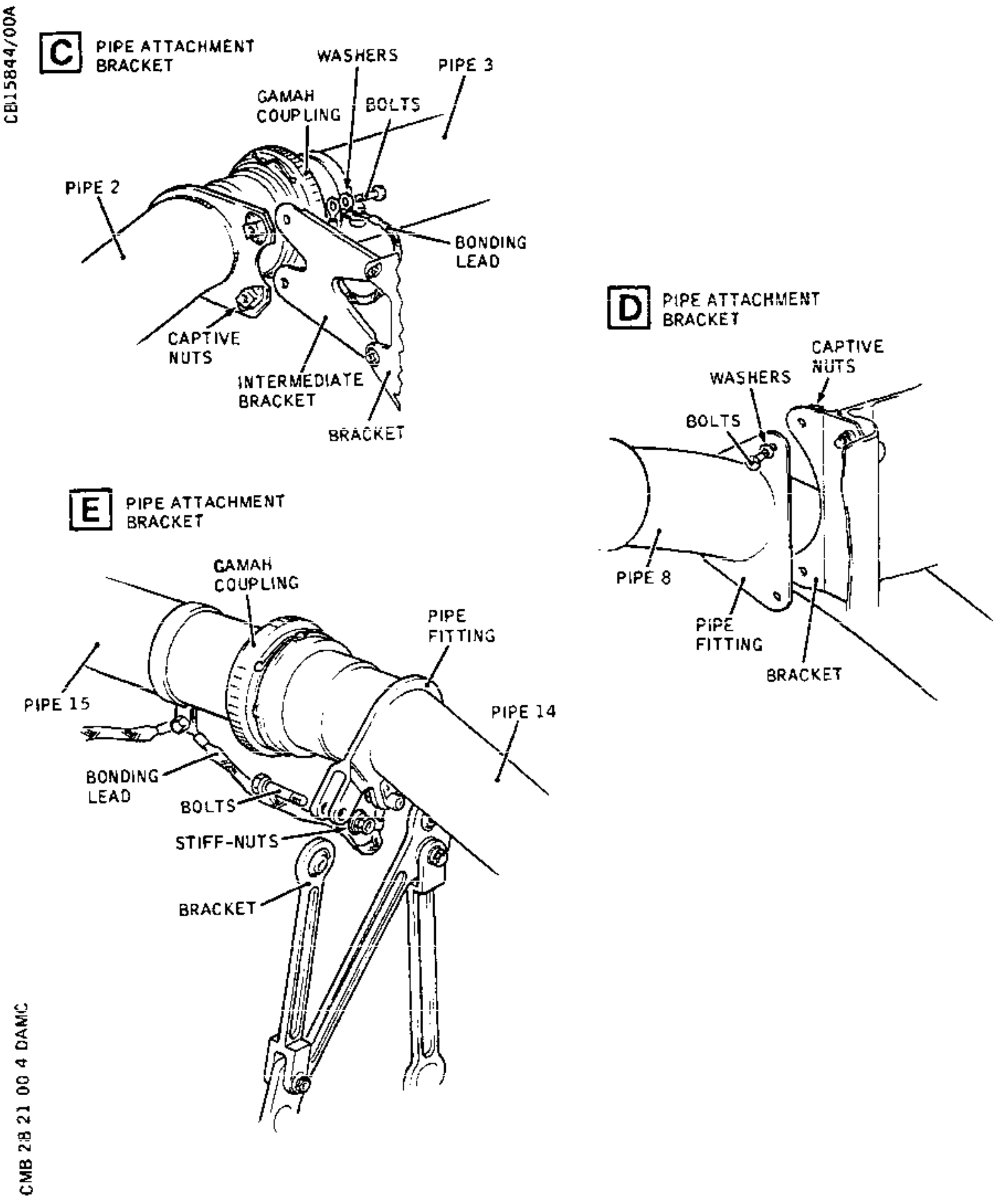

- Pipes and Attachments in Tanks 1 and 4 -
Installation (Sheet 3 of 3)
Figure 404

(e) Disengage pipe 3 from the pipe 4 sleeve; remove pipes 1, 2 and 3.

R After SB 28-018 For A/C 001-005,

R (e) Disengage pipe 3 from the pipe 4 sleeve; remove
R sealants from the bulkhead joint (Ref. para.8.)
R and remove pipes 1, 2 and 3.

(f) Remove and discard all O-ring seals.

(g) Remove the Gamah coupling components from the pipes.

(h) Remove the bonding clips from the pipes.

(i) Fit suitable blanks to the open ends of all pipes.

(2) Remove feed pipes 4 to 6, between the tank bulkhead (Detail B) and the accumulator outlet, as follows:-

(a) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

(b) Remove the four bolts and washers securing the pipe 4 flange to the bulkhead within the tank.

(c) Fully unscrew the Gamah coupling nuts (3 places); slide the nuts and snap rings carefully toward the centre of each pipe.

(d) Disconnect pipe 6 from the accumulator by removing the six bolts and washers (Ref. Fig. 403).

R Before SB 28-018

(e) Disengage pipe 6 from the accumulator outlet and then move the pipes sufficiently to disengage pipe 6 from pipe 7; remove pipes 4, 5 and 6.

R After SB 28-018 For A/C 001-005,

R (e) Disengage pipe 6 from the accumulator outlet and

R then move the pipes sufficiently to disengage
R pipe 6 from pipe 7; remove sealants from the
R bulkhead joint (Ref. para.8.) and remove pipes
R 4, 5 and 6.

(f) Remove and discard all O-ring seals from the pipes.

(g) Remove the Gamah coupling components from the pipes.

(h) Remove the bonding clips from the pipes.

(i) Fit suitable blanks to all open pipe-ends and the accumulator outlet.

(3) Remove feed pipes 7 and 8, between the accumulator outlet and the main feed pump, as follows:-

(a) Disconnect the bonding leads from the clips and lugs on the pipes; note the positions of the bonding lead attachments.

(b) Fully unscrew the Gamah coupling nut connecting pipe 7 to pipe 8; remove pipe 7.

(c) Remove the two bolts and washers securing the pipe 8 fitting to the bracket (Detail D).

(d) Remove the top section of the shroud covering the main feed pump canister (Ref. Fig. 403).

(e) Remove the eight bolts and washers securing the outlet pipe to the pump canister; note the position of the bonding bolt.

(f) Fully unscrew the Gamah coupling nut connecting pipe 8 to the outlet pipe; remove pipe 8 and the outlet pipe.

(g) Temporarily refit the top section of the shroud covering the main feed pump canister.

(h) Remove and discard all O-ring seals.

(i) Remove the Gamah coupling components from the pipes.

(j) Remove the bonding clips from the pipes.

(k) Fit suitable blanks to the open pipe-ends

and component aperture.

(4) Remove feed pipes 9 to 15, between the accumulator inlet and the standby pump canisters, as follows:-

(a) Disconnect the bonding leads from the clips and lugs on the pipes; note the positions of the bonding lead attachments.

(b) Fully unscrew the coupling nuts at the Gamah couplings (7 places); slide the nuts and snap rings carefully toward the centre of each pipe.

(c) Remove the six bolts and washers securing pipe 9 to the accumulator inlet (Ref. Fig. 403); remove pipes 9 and 10.

(d) Remove the four bolts and washers securing pipe 13 to the jettison valve canister (Ref. Fig. 403).

(e) Remove the top sections of the shrouds covering the standby pump canisters (Ref. Fig. 403).

(f) Remove the eight bolts and washers securing pipe 11 to the standby 2 pump canister; remove pipes 11, 12 and 13.

(g) Remove the two bolts and stiff-nuts connecting the pipe 14 fitting to the bracket (Detail E).

(h) Remove the eight bolts and washers securing the outlet pipe to the standby 1 pump canister; remove pipes 14, 15 and the outlet pipe.

(i) Temporarily refit the top sections of the shrouds covering the standby pump canisters.

(j) Remove and discard all O-ring seals.

(k) Remove the Gamah coupling components from the pipes.

(l) Remove the bonding clips from the pipes.

(m) Fit suitable blanks to all open pipe-ends and component apertures.

(5) Remove recirculation pipes R1 (Detail A) and R2 (Detail B), as follows:-

(a) From within tank 5 (8), remove the four bolts and washers securing the bulkhead pipe to the tank bulkhead (Detail A) and fully unscrew the Gamah coupling nut near the bulkhead.

(b) From within tank 1 (4), remove the bolts and washers securing the bonding leads to the pipes (4 places); note the positions of the bonding lead attachments.

(c) Remove the bolts and washers securing the pipe support clips; remove the clips.

(d) Remove the four bolts and washers securing the bulkhead pipe flange to the bulkhead within the tank (Detail B).

R Before SB 28-018

(e) Fully unscrew the Gamah coupling nuts (4 places); remove pipes R1, R2 and the bulkhead pipes.

R After SB 28-018 For A/C 001-005,

R (e) Fully unscrew the Gamah coupling nuts (4 places).
R Remove sealants from the bulkhead joints (Ref.
R para.8.) and remove pipes R1, R2 and the bulk-
R head pipes.

(f) Remove and discard all O-ring seals.

(g) Remove the Gamah coupling components from the pipes.

(h) Remove the bonding clips from the pipes.

(i) Fit suitable blanks to all open pipe-ends and component apertures.

D. Prepare to Install Pipes in Tank 1 or 4

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) If applicable, remove the top sections of the

shrouds covering the pump canisters.

(3) Remove the blanks from the open pipe-ends and component apertures.

(4) Before installation, ensure that all joint surfaces are clean and undamaged.

(5) Fit the bonding clips to the pipes in the positions noted during removal.

(6) Fit the Gamah coupling components to the pipes, as detailed in 20-23-21.

(7) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the Gamah couplings.

E. Install Pipes in Tank 1 or 4

(1) Install feed pipes 1 to 4, between the tank bulkhead (Detail A) and the bulkhead within the tank (Detail B), as follows:-

R Before SB 28-018

(a) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the pipe 1 flange.

R After SB 28-018 For A/C 001-005,

R (a) Apply sealants to the pipe 1 flange (Ref.
R para.8.).

(b) Position the pipe in the tank and, from within tank 5 (8), secure the pipe to the bulkhead with the six bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(c) Tighten and lock the coupling nut at the Gamah coupling in tank 5 (8), in accordance with 20-23-21.

(d) Position pipe 2 in the tank and secure it to the intermediate bracket (Detail C) with the two bolts and washers, first ensuring that the bonding lead and bonding bolt are correctly positioned; torque-tighten the bolts to between 40 and 49 lbf in (0.452

and 0.554 mdaN).

R Before SB 28-018

(e) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the pipe 4 flange.

R After SB 28-018 For A/C 001-005,

R (e) Apply sealants to the pipe 4 flange (Ref.
R para.8.).

(f) Position pipes 3 and 4 in the tank and secure pipe 4 to the bulkhead with the four bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(g) Tighten and lock the coupling nuts at the Gamah couplings of pipes 1, 2 and 3 (3 places), in accordance with 20-23-21.

(h) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(2) Install feed pipes 5 and 6, between the tank bulkhead (Detail B) and the accumulator outlet, as follows:-

(a) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the attachment flange on pipe 6.

(b) Position the pipes in the tank and secure pipe 6 to the accumulator with the six bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 70 and 80 lbf in (0.802 and 0.904 mdaN).

(c) Tighten and lock the coupling nuts at the Gamah couplings on pipes 5 and 6, in accordance with 20-23-21.

(d) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to

between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(3) Install feed pipes 7 and 8, between the accumulator and the main feed pump, as follows:-

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the pump outlet pipe.

(b) Position pipes 7 and 8, and the outlet pipe, in the tank; attach the outlet pipe to the main pump canister with the eight bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(c) Tighten and lock the coupling nuts at the Gamah couplings on pipes 7 and 8, in accordance with 20-23-21; check that the pipe end-float is correct.

(d) Secure pipe 8 to the bracket on the bulkhead (Detail D) with the two bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(e) Attach the bonding leads, in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(4) Install feed pipes 9 to 15, between the accumulator inlet and the jettison valve and standby pump canisters, as follows:-

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the attachment flange on pipe 9.

(b) Secure pipe 9 to the accumulator with the six bolts and washers, first ensuring that the bonding bolt and lead are correctly positioned; torque-tighten the bolts to between 70 and 80 lbf in (0.802 and 0.904 mdaN).

(c) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the attachment

flange on pipe 11.

(d) Position pipes 10 and 11 in the tank and secure pipe 11 to the standby 2 pump canister with the eight bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(e) Tighten and lock the coupling nuts at the Gamah couplings on pipes 9, 10 and 11 (2 places), in accordance with 20-23-21.

(f) Lubricate a new O-ring in seal in accordance with 20-23-11, and fit it to the attachment flange on pipe 13; position pipes 12 and 13 in the tank and secure pipe 13 to the jettison valve canister with the four bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(g) Tighten and lock the coupling nuts at the Gamah couplings on pipes 12 and 13 (2 places), in accordance with 20-23-21.

(h) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the standby 1 pump outlet pipe.

(i) Position pipes 14, 15 and the pump outlet pipe in the tank; secure the outlet pipe to the standby 1 pump canister with the six bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(j) Tighten and lock the coupling nuts at the Gamah couplings of pipes 14 and 15 (3 places), in accordance with 20-23-21; ensure that the end-float is correct.

(k) Secure pipe 14 to the bracket (Detail E) with the two bolts and stiff-nuts; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(l) Attach the bonding leads, in the positions noted during removal, using the bolts and

washers. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(5) Install recirculation pipes R1 (Detail A) and R2 (Detail B), as follows:

Before SB 28-018

(a) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the bulkhead pipe (Detail A).

After SB 28-018 For A/C 001-005,

(a) Apply sealants to the flange of the bulkhead pipe (Detail A) (Ref. para.8.).

(b) Position the bulkhead pipe in tank 1 (4). From within tank 5 (8), secure the pipe flange to the tank bulkhead with the four bolts and washers. Torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(c) Tighten and lock the coupling nut at the Gamah coupling within tank 5 (8), in accordance with 20-23-21.

Before SB 28-018

(d) Lubricate a new O-ring seal in accordance with 20-23-11, and fit it to the flange on the bulkhead pipe (Detail B).

After SB 28-018 For A/C 001-005,

(d) Apply sealants to the flange of the bulkhead pipe (Detail B) (Ref. para.8.).

(e) Position pipe R1 and the bulkhead pipe in the tank. Secure the bulkhead pipe flange to the bulkhead within the tank with the four bolts and washers. Torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(f) Position pipe R2 in the tank and tighten and lock, in accordance with 20-23-21, the coupling nuts at the Gamah couplings of pipes R1 and R2 (4 places).

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(g) Secure the pipes to the structure with the pipe support clips, bolts and washers. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(h) Attach the bonding leads, in the positions noted during removal, using the bolts and washers. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

F. Conclusion

(1) Refit, as necessary, the top sections of the shrouds covering the engine feed pump canisters.

(2) Check that all electrical bonding between the disturbed pipes, components and structure is in accordance with 20-27-11.

(3) Refit the tank bracing struts (Ref. 57-15-10, Removal/ Installation).

(4) Refit the fuel quantity probes (Ref. 28-44-**, Removal/ Installation).

** As appropriate.

(5) Ensure that all tools, equipment etc., have been removed from the tanks.

(6) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(7) Carry out a Leakage Test of the disturbed pipes (Ref. Adjustment/Test).

R (8) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R <u>NOTE</u>: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (9) Refit the tank access panels (Ref. 57-00-00, Removal/ Installation).

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R (10) Switch off and disconnect electrical ground power as detailed in 24-41-00.

6. System Pipes - in Tanks 6 and 7 (Ref. Fig. 405)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

NOTE: The arrangement of the pipes in the wing cell of tank 7 is similar, but of opposite hand to that in tank 6. There is no centre cell in tank 7, and therefore that part of these procedures which concerns the removal and installation of cross-feed piping in the centre cell is applicable to tank 6 only.

Otherwise, the following procedures apply to both tanks. The unbracketed numbers refer to tank 6 installation and the bracketed numbers refer to tank 7 installation. For the purpose of reference within this topic, the main feed pipes are numbered from 1 to 10, the recirculation pipes are numbered from R1 to R4, and the cross-feed pipes in the centre cell are numbered C1 and C2.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 75 to 125 lbf in (0.847 to 1.412 mdaN)	-
Rubber-backed mats, to protect wing top surface	-
Key, for wing access panel	E920132000

B. Prepare to Remove Pipes in Tank 6 or 7

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Defuel and drain the tank (Ref. 28-25-00, Servicing).

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(3) Isolate the electrical generation and ground power supplies as detailed in 24-00-00, Servicing.

(4) Remove the appropriate panels (Ref. Fig. 405) as detailed in 53-00-00 and 57-00-00, Removal/Installation, to gain access to the tank.

(5) Open the dry bay access panel (Ref. Fig. 405), using the key.

(6) Prepare the tank for entry as detailed in 28-10-00, Servicing.

(7) Remove the removable tank bracing struts (Ref. 57-15-10, Removal/Installation), as required, to gain access to the pipes.

(8) Remove the fuel quantity probes (Ref. 28-44-**, Removal/ Installation), as required, to gain access to the pipes.

** As appropriate.

C. Remove Pipes in Tank 6 or 7

NOTE: When the pipes are disconnected, the fuel trapped in the pipelines will be spilled. When the spillage ceases, further drainage must be carried out at the appropriate water drain.

(1) Remove feed pipes 1 to 3 at the rear bulkhead (Detail A), as follows:

(a) From within the dry bay, remove the four bolts and washers securing pipe 1 flange to the bulkhead. Fully unscrew the Gamah coupling nut and disconnect the bonding lead on pipe 1 (Detail A).

(b) In tank 6 (7), remove the four bolts and washers securing the retaining flanges of spool 1 and pipe 2 to the LP valve canister.

(c) Disconnect the bonding leads from the pipes. Note the positions of the bonding lead attachments.

(d) Remove the bolts and washers securing pipe 3 to the bulkhead brackets.

(e) Fully unscrew the Gamah coupling nuts at the

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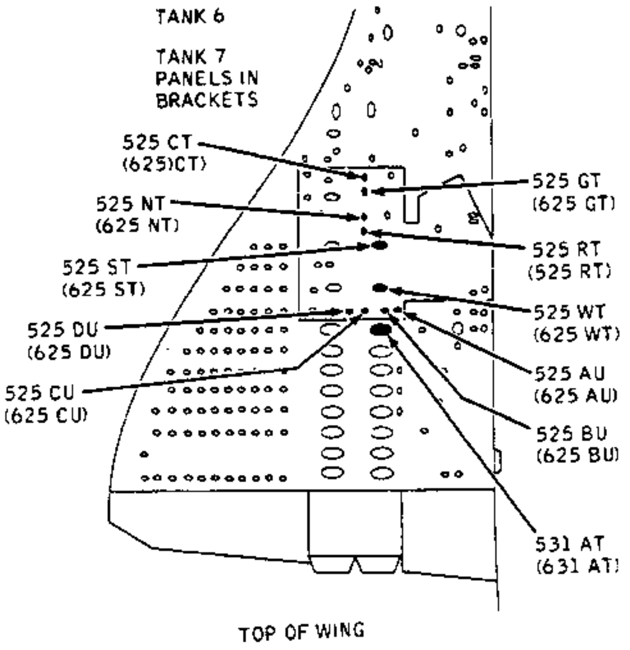

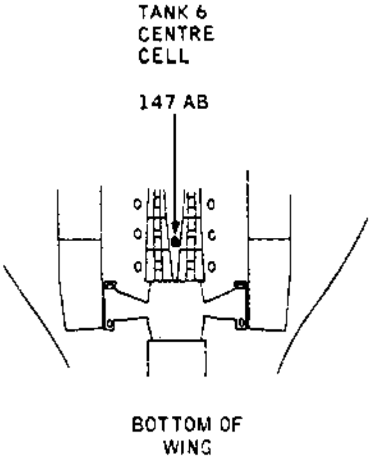

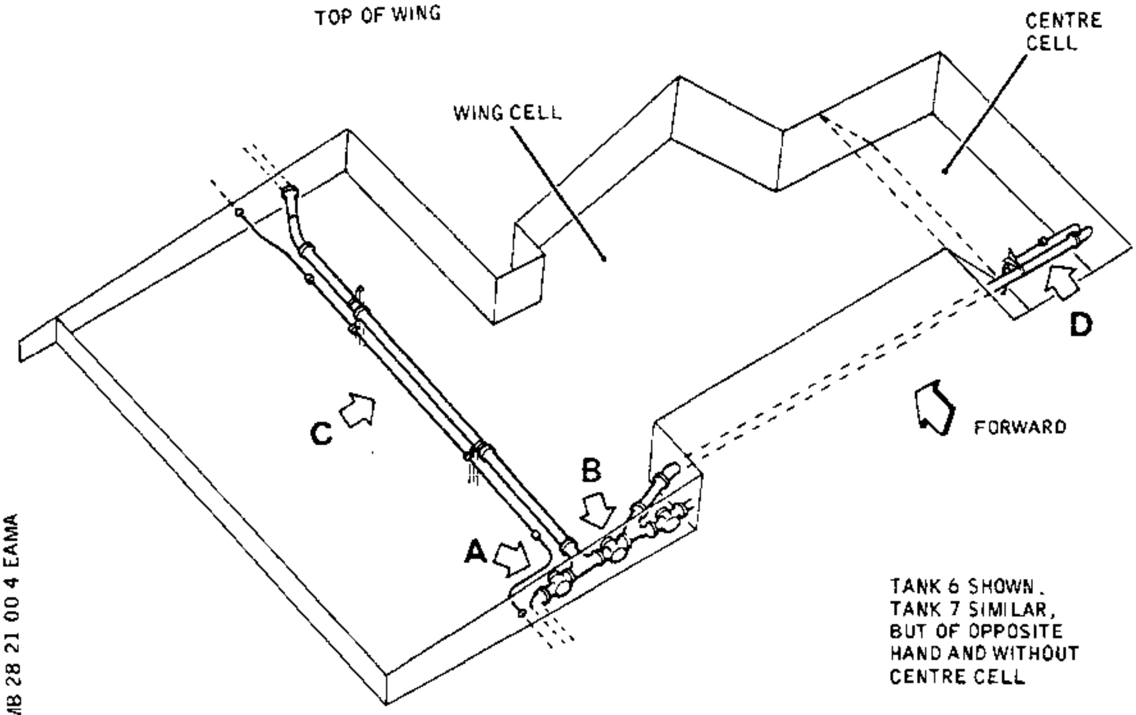

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\- Pipes and Attachments in Tanks 6 and 7 -
Installation (Sheet 1 of 4)
Figure 405

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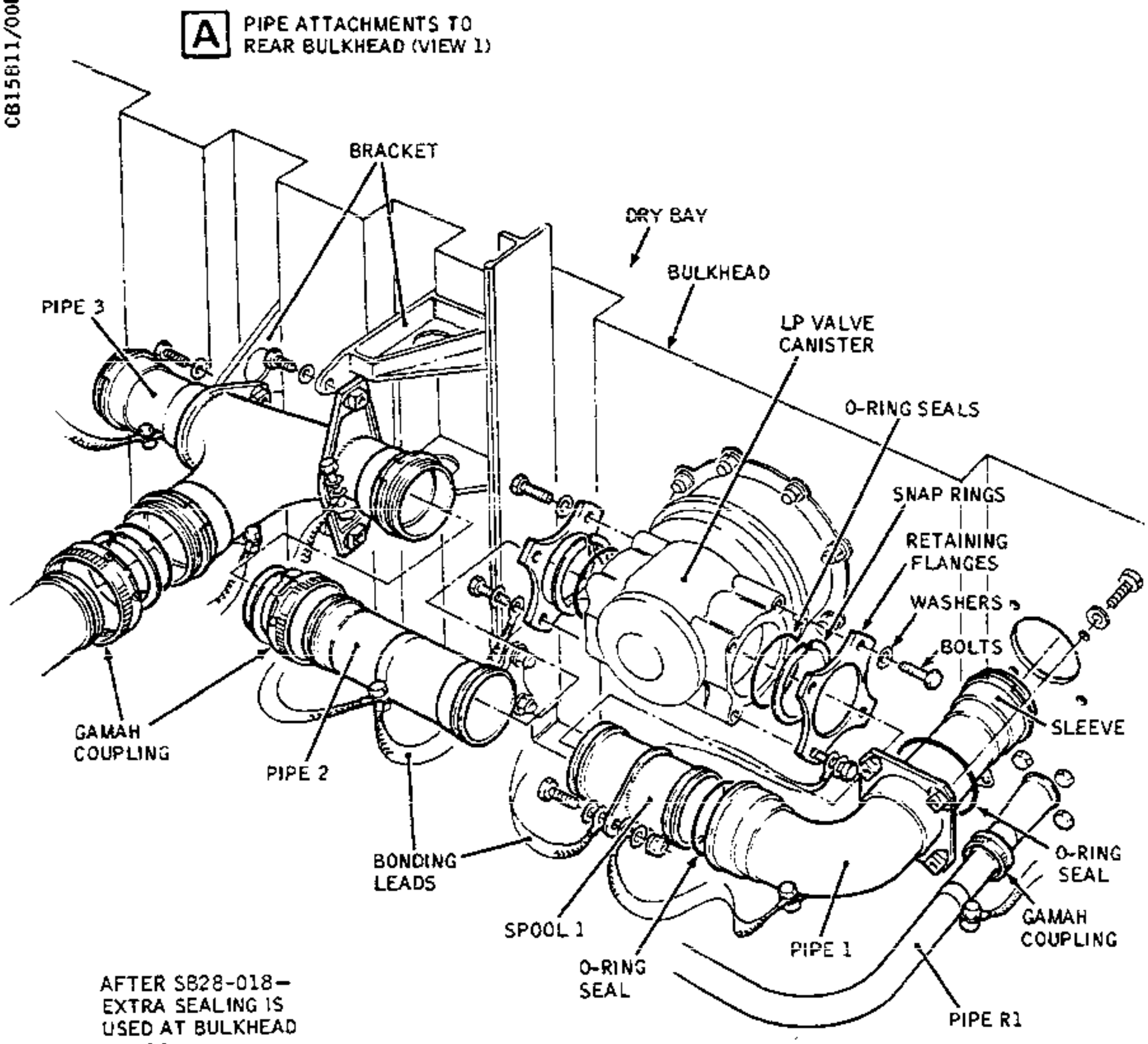
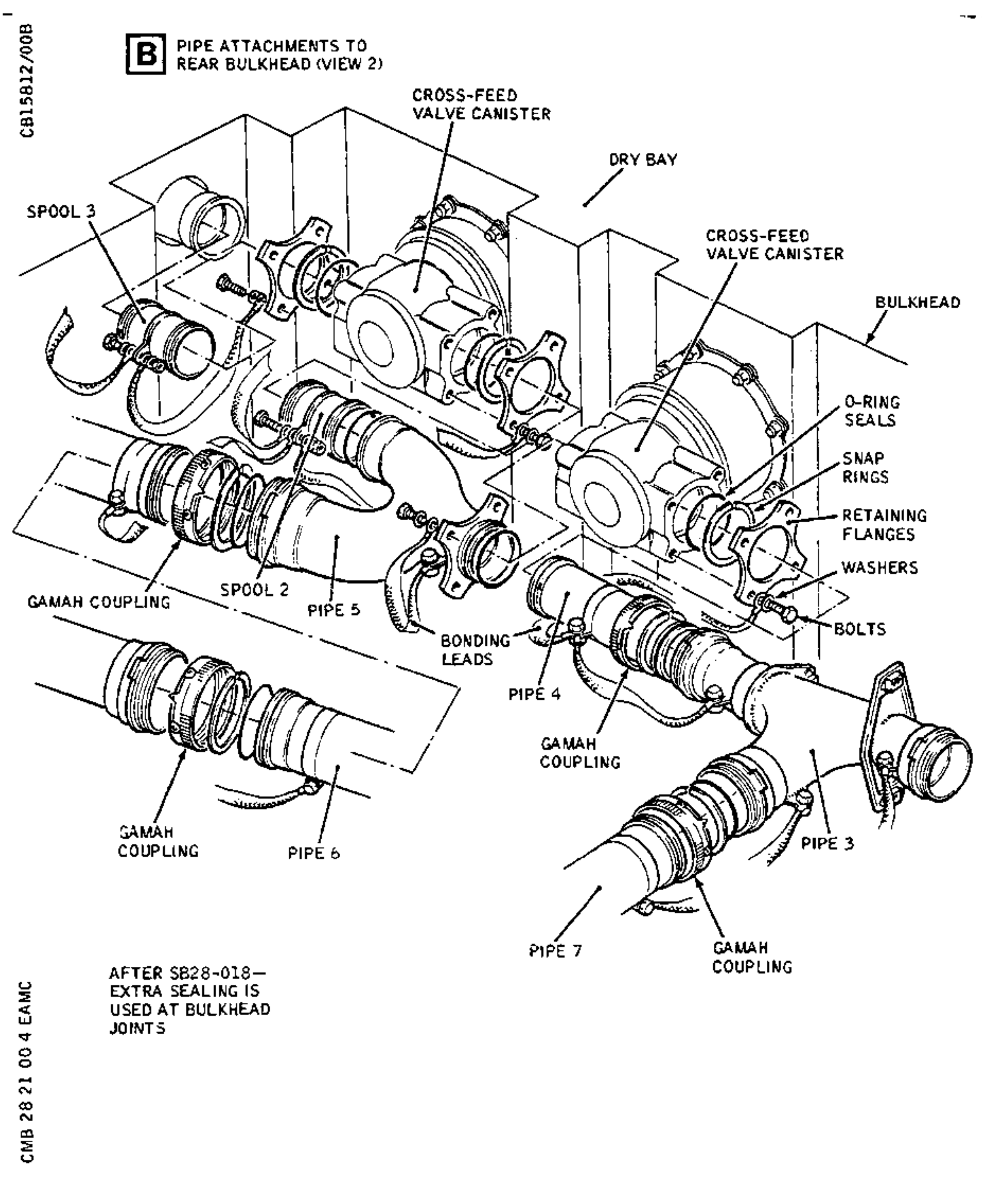


AFTER SB28-018—
EXTRA SEALING IS
USED AT BULKHEAD
JOINTS

CMB 28 21 00 4 EAMB

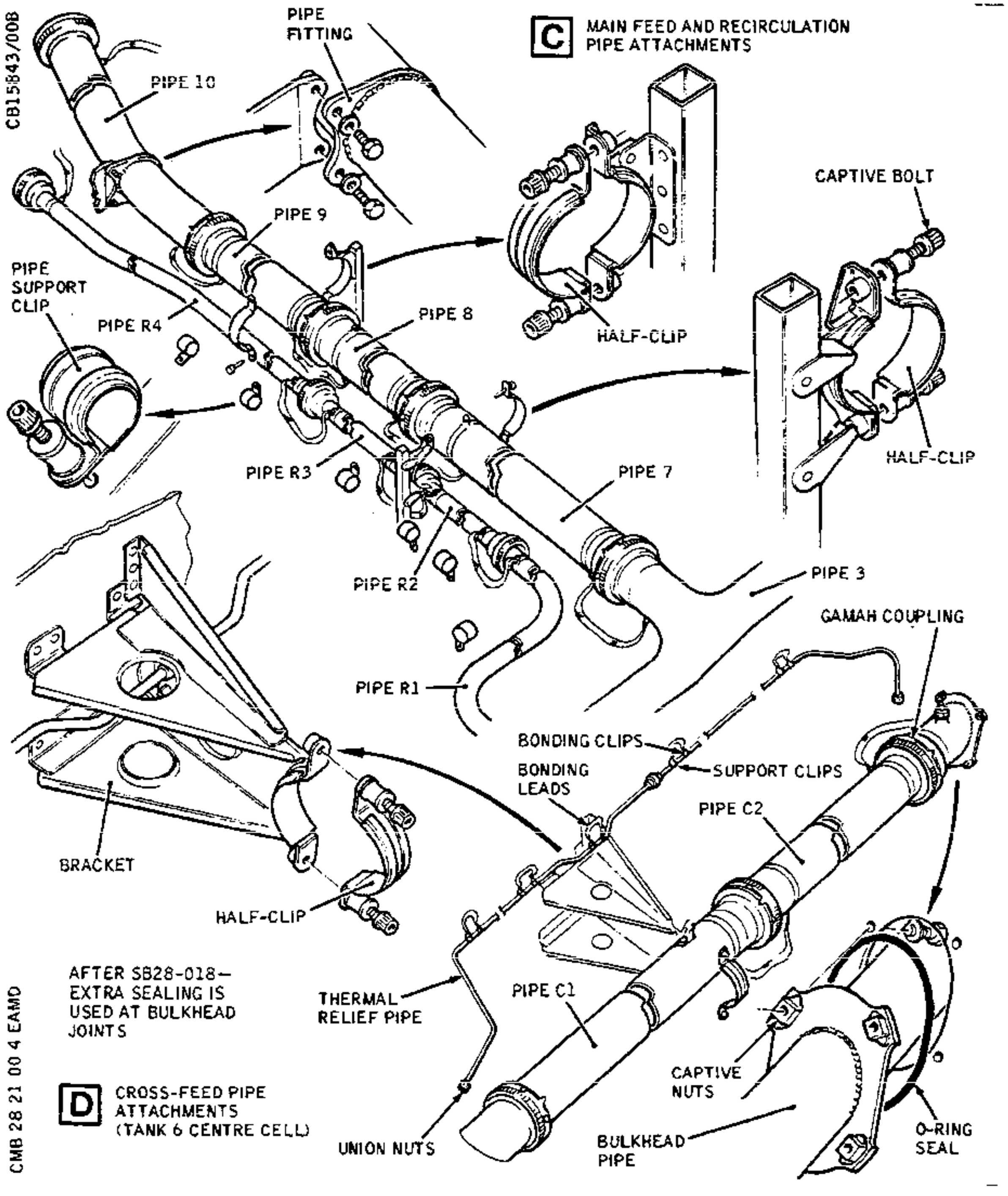
- Pipes and Attachments in Tanks 6 and 7 -
Installation (Sheet 2 of 4)
Figure 405

R



- Pipes and Attachments in Tanks 6 and 7 -
Installation (Sheet 3 of 4)
Figure 405

R



- Pipes and Attachments in Tanks 6 and 7 -
Installation (Sheet 4 of 4)
Figure 405

R

couplings on pipe 3 (3 places).

R NOTE: If difficulty is encountered in removing
R pipe 1 and spool 1, remove the LP isolation
R valve canister in accordance with 28-21-43.

Before SB 28-018

(f) Move pipe 1 away from the LP valve canister until the pipe sleeve is clear of spool 1; remove pipe 1 and spool 1.

After SB 28-018 For A/C 001-005,

(f) Remove sealants from the bulkhead joint (Ref. para.8.). Move pipe 1 away from the LP valve canister until the pipe sleeve is clear of spool 1; remove pipe 1 and spool 1.

(g) Move pipe 2 toward the LP valve canister and then, moving it sideward the minimum amount, disengage it from the pipe 3 sleeve; remove pipes 2 and 3.

(h) Remove and discard all O-ring seals.

(i) Remove the Gamah coupling components and retaining flanges from the pipes.

(j) Remove the bonding leads and clips from the pipes.

(k) Fit suitable blanks to the open ends of all pipes and component apertures.

(2) Remove feed pipes 4 to 6 at the rear bulkhead (Detail B), as follows:-

(a) Remove the bolts and washers securing the retaining flanges on each side of the cross-feed valve canisters.

(b) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

(c) Fully unscrew the Gamah coupling nuts at the couplings on pipes 4, 5 and 6 (3 places).

(d) Disengage pipe 4 from the cross-feed valve canister; remove the pipe.

(e) Disengage pipe 6 from pipe 5 sleeve; remove

pipe 6.

(f) Disengage the other sleeve of pipe 5 from spool 2; turn the pipe and remove it from the cross-feed valve canister. Remove spool 2 from the other canister.

(g) Remove the pipe at the bulkhead (Ref. para.4., pipe 3) sufficiently to allow the removal of spool 3; remove spool 3 from the cross-feed valve canister.

(h) Remove and discard the O-ring seals.

(i) Remove the Gamah coupling components and retaining flanges from the pipes.

(j) Remove the bonding leads and clips from the pipes.

(k) Fit suitable blanks to the open ends of all pipes and component apertures.

(3) Remove feed pipes 7 to 10, between the front and the rear bulkheads (Detail C), as follows:-

(a) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

(b) Fully unscrew the Gamah coupling nuts at the pipe couplings (4 places); slide the nuts and snap rings toward the centre of each pipe, ensuring that the protective surface is not damaged.

(c) Release the captive bolts securing the half-clips on pipes 7 and 9; remove the half-clips.

(d) Remove the two bolts and washers securing the fitting on pipe 10 to the bracket.

(e) Remove pipes 7, 8, 9 and 10 from the tank.

(f) Remove and discard all O-ring seals.

(g) Remove the Gamah coupling components from the pipes.

(h) Remove the bonding clips from the pipes.

(i) Fit suitable blanks to the open ends of all pipes.

(4) Remove recirculation pipes R1 to R4 (Details A and C), as follows:-

(a) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

(b) Fully unscrew the Gamah coupling nuts at the pipe couplings (5 places).

(c) Release the captive bolts, or remove the bolts and washers, securing the pipe support clips (6 places).

(d) Remove pipes R1, R2, R3 and R4.

(e) Remove and discard all O-ring seals.

(f) Remove the Gamah coupling components from the pipes.

(g) Remove the bonding clips from the pipes.

(h) Fit suitable blanks to the open ends of all pipes.

(5) Remove cross-feed pipes C1 and C2, in tank 6 centre cell (Detail D), as follows:-

(a) Disconnect the bonding leads from the pipes; note the positions of the bonding lead attachments.

(b) Fully unscrew the Gamah coupling nuts at the pipe couplings (3 places).

(c) Release the captive bolts securing the half-clip to the bracket.

(d) Remove pipes C1 and C2 from the tank.

(e) Remove and discard all O-ring seals.

(f) Remove the Gamah coupling components from the pipes.

(g) Remove the bonding clips from the pipes.

(h) Fit suitable blanks to the open ends of all pipes.

(6) Remove the cross-feed thermal relief pipe, in tank 6 centre cell (Detail D), as follows:-

(a) Disconnect the union nuts at each end of the pipe.

(b) Remove the bolts and washers securing the pipe support clips (5 places).

(c) Remove the pipe; disconnect the union nut securing the two sections of the pipe.

(d) Remove the bolts and nuts securing the bonding leads to the clips (4 places); remove the clips.

(e) Fit suitable blanks to the open ends of all pipes.

D. Prepare to Install Pipes in Tank 6 or 7

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the open pipe-ends and component apertures.

(3) Before installation, ensure that all joint surfaces are clean and undamaged.

(4) Fit the bonding clips to the pipes in the positions noted during removal.

(5) Fit the Gamah coupling components and retaining flanges to the pipes, as detailed in 20-23-21.

(6) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the Gamah couplings.

E. Install Pipes in Tank 6 or 7

R NOTE: If the LP isolation valve canister was removed
R in procedure C: during the installation of
R pipe 1 and spool 1, refit the canister in
R accordance with 28-21-43.

(1) Install feed pipes 1 to 4 at the rear bulkhead bulkhead (Details A and B), as follows:-

Before SB 28-018

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to spool 1 and pipe 1

flange; insert spool 1 into pipe 1 and position the assembly in the tank.

R After SB 28-018 For A/C 001-005,

R (a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the spool 1. Apply sealants to the pipe 1 flange (Ref. para.8.). Insert spool 1 into pipe 1 and position the assembly in the tank.

(b) From within the dry bay, check that the end-float of pipe 1 Gamah coupling is correct (Ref. 20-23-21). Secure pipe 1 flange to the bulkhead with the four bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN). Tighten and lock the Gamah coupling nut in accordance with 20-23-21.

(c) Secure the retaining flange on spool 1 to the LP valve canister with the four bolts and washers, first ensuring that the bonding lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(d) Insert pipes 2 and 4 into the sleeve of pipe 3 and position the pipes in the tank; check that the end-float at pipe 2 and pipe 4 Gamah couplings is correct (Ref. 20-23-21).

(e) Secure pipe 3 to the bulkhead brackets with the three bolts and washers, first ensuring that the bonding bolts are correctly positioned; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(f) Secure the retaining flange on pipe 2 to the LP valve canister with the four bolts and washers, first ensuring that the bonding lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(g) Secure the retaining flange on pipe 4 to the cross-feed valve canister with the four bolts and washers, first ensuring that the bonding

lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(h) Tighten and lock the Gamah coupling nuts on pipes 2 and 4 in accordance with 20-23-21.

(i) Attach the bonding leads to the clips on pipes 2 and 4, using the bolts and nuts; torque-tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(j) Attach the bonding leads to the lugs on pipe 1, pipe 3 and spool 1, using the bolts, washers and, if applicable, nuts; torque-tighten the bolts (or nuts) to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(2) Install feed pipes 5 and 6 at the rear bulkhead (Detail B), as follows:-

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to spool 2; insert spool 2 and pipe 6 into pipe 5.

(b) Position the assembled pipes in the tank and secure the retaining flange of spool 2 to the cross-feed valve canister with the four bolts and washers, first ensuring that the bonding lead is correctly positioned under the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(c) Ensure that the end-float at the Gamah couplings is correct (Ref. 20-23-21) and then tighten and lock the coupling nuts in accordance with 20-23-21.

(d) Fit new O-ring seals, lubricated in accordance with 20-23-11, to spool 3; position spool 3 in the tank and secure its retaining flange to the cross-feed valve canister with the four bolts and washers, first ensuring that the bonding lead is correctly positioned beneath the bonding bolt; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(e) Refit the bulkhead pipe adjoining spool 3 (Ref. para.4., pipe 3).

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(f) Attach the bonding leads in the positions noted during removal, using the bolts, washers and nuts; torque-tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(3) Install feed pipes 7 to 10, between the front and rear bulkheads (Detail C), as follows:-

(a) Position pipes 7, 8, 9 and 10 in the tank; support the pipes in position by fitting the half-clips to the brackets; do not tighten the captive bolts, securing the half-clips, at this stage.

(b) Check that the end-float at each Gamah coupling is correct (5 places) (Ref. 20-23-21).

(c) Torque-tighten the half-clip captive bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(d) Secure the pipe fitting of pipe 10 to the bracket with the two bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(e) Tighten and lock the Gamah coupling nuts (5 places) in accordance with 20-23-21.

(f) Attach the bonding leads in the positions noted during removal, using the bolts, washers and nuts; torque-tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(4) Install recirculation pipes R1 to R4 (Detail C), as follows:-

(a) Position pipes R1, R2, R3 and R4 in the tank; support the pipes in position by fitting the pipe support clips in the positions noted during removal; do not tighten the support clip bolts at this stage.

(b) Check that the end-float at each Gamah coupling is correct (5 places) (Ref. 20-23-21).

(c) Torque-tighten the pipe support clip bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(d) Tighten and lock the Gamah coupling nuts (5 places) in accordance with 20-23-21.

(e) Attach the bonding leads in the positions noted during removal, using the bolts, washers and nuts; torque-tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(5) Install cross-feed pipes C1 and C2, in tank 6 centre cell (Detail D), as follows:-

(a) Position pipes C1 and C2 in the tank; support the pipes in position by fitting the half-clip to the bracket; do not tighten the captive bolts securing the half-clip at this stage.

(b) Check that the end-float at each Gamah coupling is correct (3 places) (Ref. 20-23-21).

(c) Torque-tighten the half-clip captive bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(d) Tighten and lock the Gamah coupling nuts (3 places) in accordance with 20-23-21.

(e) Attach the bonding leads in the positions noted during removal, using the bolts, washers and nuts; torque-tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(6) Install the cross-feed thermal relief pipe in tank 6 centre cell (Detail D), as follows:-

(a) Position the two sections of the pipe in the tank and join them by connecting the union nut, hand-tight only.

(b) Connect the union nuts at each end of the pipe.

(c) Attach the pipe support clips (5 places) and bonding leads, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(d) Torque-tighten the union nuts to between 75 and 125 lbf in (0.847 and 1.412 mdaN).

(e) Attach the bonding leads to the bonding clips (5 places) with the bolts and nuts; torque-

tighten the nuts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

F. Conclusion

(1) Check that all electrical bonding between the disturbed pipes, structure and components is in accordance with 20-27-11.

(2) Refit the tank bracing struts (Ref. 57-15-10, Removal/Installation).

(3) Refit the fuel quantity probes (Ref. 28-44-**, Removal/Installation).

** As appropriate.

(4) Ensure that all tools, equipment etc., have been removed from the tank.

(5) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(6) Carry out a Leakage Test of the disturbed pipes (Ref. Adjustment/Test).

R (7) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (8) Refit the access panels (Ref. 53-00-00 and 57-00-00,
Removal/Installation.

R (9) Fit the dry bay access panel, using the key.

R (10) Switch off and disconnect electrical ground power as
detailed in 24-41-00.

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7. System Pipes - in Tanks 5 and 8 (Ref. Fig. 406)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

NOTE: The arrangement of the pipes in tank 8 is similar, but of opposite hand, to that in tank 5. The following procedures are applicable to both tanks, the unbracketed numbers refer to tank 5 installation, and the bracketed numbers refer to tank 8 installation. For the purpose of reference within this topic, the main feed pipes are numbered from 1 to 3, and the recirculation pipes are numbered from R1 to R3.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Rubber-backed mats, to protect wing top surface	-
After SB 28-037 For A/C 002-005,	
Shims, for gap adjustment	-

B. Prepare to Remove Pipes in Tank 5 or 8

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Defuel and drain tank 5 (8) (Ref. 28-25-00, Servicing).

(3) Isolate the electrical generation and ground power supplies as detailed in 24-00-00, Servicing.

(4) Remove the appropriate panels (Ref. Fig. 406) as detailed in 57-00-00, Removal/Installation, to gain access to the tank.

(5) Prepare tank 5 (8) for entry as detailed in 28-10-00, Servicing.

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(6) Remove the removable tank bracing struts (Ref. 57-15-10, Removal/Installation), as required, to gain access to the pipes.

(7) Remove the fuel quantity probes (Ref. 28-44-**, Removal/Installation), as required, to gain access to the pipes.

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** As appropriate.

C. Remove Pipes in Tank 5 or 8

NOTE: When the pipes are disconnected, the fuel trapped in the pipelines will be spilled. When the spillage ceases, further drainage must be carried out at the appropriate water drain.

(1) Remove feed pipes 1 to 3, and their short connecting pipes at spar 54 and false spar 51, as follows:-

(a) Disconnect the bonding leads from pipes 1 to 3 (6 places); note the positions of the bonding lead attachments.

(b) Fully unscrew the Gamah coupling nuts (6 places); slide the nuts and snap rings toward the centre of each pipe, ensuring that the protective surface is not damaged.

Before SB 28-037

(c) Remove the two bolts and washers securing spar 54 pipe flange to the structure connection lugs.

After SB 28-037 For A/C 002-005,

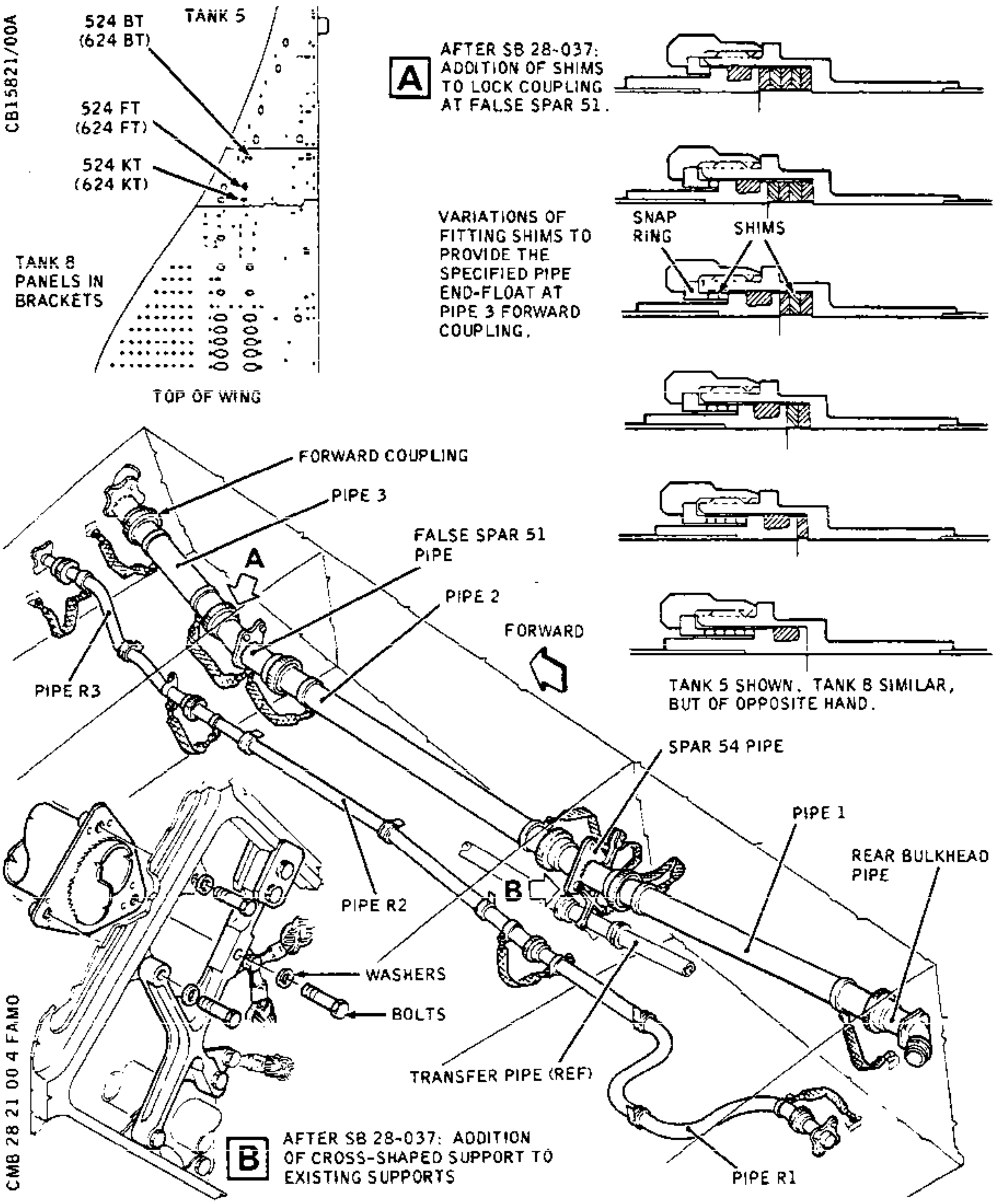
(c) Remove the three bolts and washers securing spar 54 pipe flange to the structure connection lugs and the cross-shaped support (Detail B).

(d) Remove the two bolts and washers securing false spar 51 pipe flange to spar 51 structure.

(e) Move pipe 2 and spar 54 pipe toward the forward bulkhead and carefully disengage pipe 1 from spar 54 pipe sleeve; remove pipe 1.

(f) Move pipe 2 and spar 54 pipe toward the rear bulkhead and carefully disengage pipe 2 from false spar 51 pipe sleeve; remove pipe 2.

(g) Remove spar 54 pipe, false spar 51 pipe and pipe 3.



- Pipes and Attachments in Tanks 5 and 8 -
Installation
Figure 406

Before SB 28-037

(h) Disconnect the bonding leads from spar 54 pipe flange and false spar 51 pipe lug.

After SB 28-037 For A/C 002-005,

(h) Disconnect the bonding leads from false spar 51 pipe lug.

(i) Remove and discard all O-ring seals.

Before SB 28-037

(j) Remove the Gamah coupling components from the pipes.

After SB 28-037 For A/C 002-005,

(j) Remove the Gamah coupling components from the pipes and note carefully the position and number of shims, used to lock the coupling of pipe 3 to false spar 51 pipe (Detail A).

(k) Remove the bonding clips from the pipes.

(l) Fit suitable blanks to the open ends of all pipes.

(2) Remove recirculation pipes R1 to R3, as follows:-

(a) Remove the bolts and washers securing the bonding leads to the clips (6 places).

(b) Remove the bolts and washers securing the pipe support clips (6 places); remove the clips.

(c) Fully unscrew the Gamah coupling nuts (4 places).

(d) Remove the pipes.

(e) Remove and discard all O-ring seals.

(f) Remove the Gamah coupling components from the pipes.

(g) Fit suitable blanks to the open ends of all pipes.

D. Prepare to Install Pipes in Tank 5 or 8

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the open pipe-ends.

(3) Before installation, ensure that all joint surfaces are clean and undamaged.

(4) Fit the bonding clips to the pipes in the positions noted during removal.

(5) Fit the Gamah coupling components to the pipes, as detailed in 20-23-21.

(6) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the Gamah couplings.

E. Install Pipes in Tank 5 or 8

(1) Install feed pipes 1 to 3, and their short connecting pipes at spar 54 and false spar 51, as follows:-

Before SB 28-037

(a) Position pipe 3 and false spar 51 pipe in the tank.

After SB 28-037 For A/C 002-005,

(a) Position pipe 3 and false spar 51 pipe in the tank and lock the rear coupling by the addition of shims (Detail A), as follows:-

a1) Fit the shims to the coupling in the positions noted during removal. If the shim positions are not known, fit three in the coupling sleeve and two behind the snap ring on the flange.

a2) Tighten and lock the Gamah coupling nut in accordance with 20-23-21, but ensure that there is no movement of the pipe within the coupling.

a3) Fully insert the combined pipes into the sleeve of the forward bulkhead pipe and then measure the gap between the mating faces of the attachment flange and structure at false spar 51.

a4) The gap dimension must be a minimum of 0.138 in (3.5 mm) and must not be more than 0.205 in (5.2 mm). If this has not been achieved, remove the pipes and refit the shims in different positions (Detail A) until the minimum clearance is obtained.

NOTE: When the pipe is later bolted to the structure the above procedure will provide a pipe end-float of 0.138 in (3.5 mm) (min.) at pipe 3 forward coupling.

(b) Secure the attachment flange of the pipe at false spar 51 to the structure with the two bolts and washers, first ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

(c) Tighten and lock the Gamah coupling nuts at each end of pipe 3, in accordance with 20-23-21.

(d) Position pipes 1 and 2 and spar 54 pipe in the tank.

Before SB 28-037

(e) Secure the attachment of the pipe at spar 54 to the structure with the two bolts and washers; torque-tighten the bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

After SB 28-037 For A/C 002-005,

(e) Secure the attachment flange of the pipe at spar 54 to the structure and the cross-shaped support with the three bolts and washers (Detail B); torque-tighten the 1/4 in (6.35 mm) dia. bolts to between 40 and 49 lbf in (0.452 and 0.554 mdaN), and the 3/16 in (4.82 mm) dia.

bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(f) Check that the pipe end-float is correct and then tighten and lock the Gamah coupling nuts at each end of pipes 1 and 2, in accordance with 20-23-21.

(g) Attach the bonding leads to the pipes, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(2) Install recirculation pipes R1 to R3, as follows:-

(a) Position the pipes in the tank and secure them with the pipe support clips, bolts and washers; do not tighten the bolts at this stage.

(b) Check that the pipe end-float is correct at each coupling and then tighten and lock the Gamah coupling nuts (4 places) in accordance with 20-23-21.

(c) Torque-tighten the support clip bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(d) Attach the bonding leads in the positions noted during removal, using the bolts and washers; torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

F. Conclusion

(1) Check that all electrical bonding between the disturbed pipes and structure is in accordance with 20-27-11.

(2) Refit the tank bracing struts (Ref. 57-15-10, Removal/Installation).

(3) Refit the fuel quantity probes (Ref. 28-44-**, Removal/Installation).

** As appropriate.

(4) Ensure that all tools, equipment etc., have been removed from the tank.

(5) Cancel the electrical safety precautions (Ref.

24-00-00, Servicing) and remove the warning notices.

(6) Carry out a Leakage Test of the disturbed pipes (Ref. Adjustment/Test).

R (7) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (8) Refit the access panels (Ref. 57-00-00, Removal/
Installation).

R (9) Switch off and disconnect electrical ground power as
detailed in 24-41-00.

After SB 28-018 For A/C 001-005,

8. Sealing of Pipe Pressure Seals (Ref. Fig. 407)

A. Equipment and Materials

DESCRIPTION	PART NO.
Sealant tools for removal/application of sealants (Ref. 28-11-00, Approved Repairs - Sealants)	-
Sealants etc.	-
PR1720R (Ref. 20-30-00, No. 390)	-
PR1720SM (Ref. 20-30-00, No. 351)	-
PR1720F (Ref. 20-30-00, No. 352)	-
Cyclohexanone, for use with sealant PR1720R	-

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DESCRIPTION	PART NO.
Cleaning solvents	-
Methylethylketone (MEK) (Ref. 20-30-00, No. 470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No. 483)	-
Halogenated hydrocarbon solvent R.113 (Ref. 20-30-00, No. 484)	-
RB Eurotwill cloth	-

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WARNING: SOLVENT 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC. R.113 IS TOXIC.

TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS WHEN USING CLEANING SOLVENTS.

B. Remove Sealants

(1) Using the sealant tools and solvent, carefully remove the sealant from the fasteners of the pipe pressure seal joint.

(2) Remove the fasteners from the pipe pressure seal joint as detailed in the appropriate section of this topic.

(3) Using solvent and the sealant cutting tool, carefully separate the pipe joint from the tank wall/bulkhead.

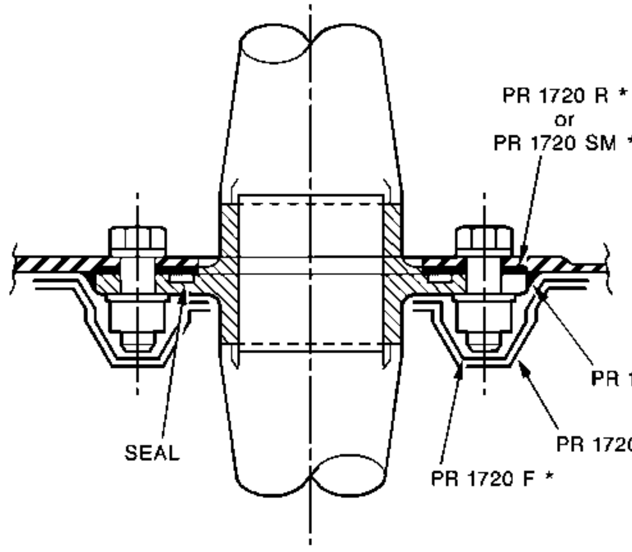
(4) Remove the seal from the pipe joint and thoroughly clean off any remaining sealant.

C. Apply Sealants

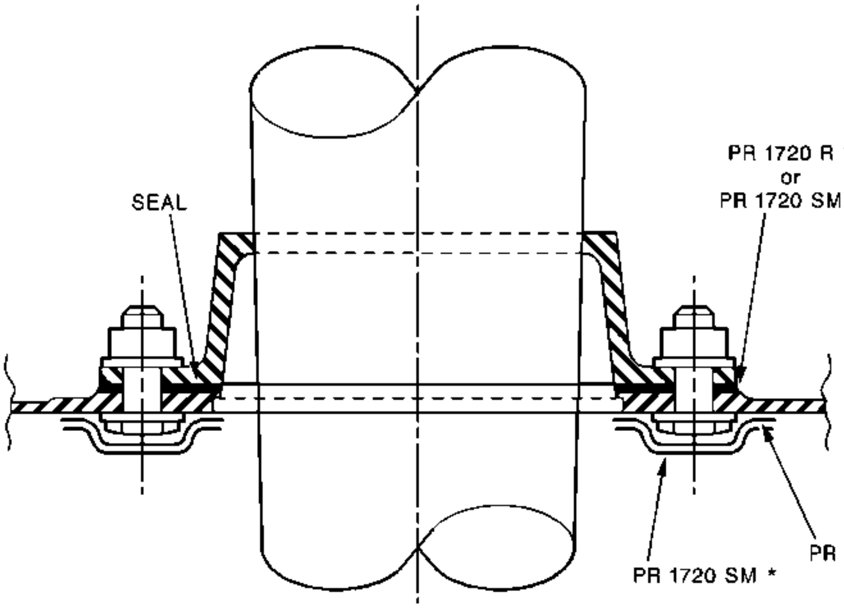
(1) Refer to 20-22-12 for the mixing and procedural use of sealants.

(2) Insert the new, dry seal in the seal groove of the pipe joint. Apply either of the following sealants:

(a) PR1720R (prefabricated tape), reactivated with cyclohexanone, in accordance with 20-22-21.



TYPICAL AIR FUEL PRESSURE SEALS



* SEALANTS - REF.20-30-00

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Sealing of Pipe Pressure Seals
Figure 407

(b) PR1720SM (semi-paste/fluid), applied by brush or spatula in accordance with 20-22-21, where tape cannot be applied.

(3) Reassemble the pipe joint to the tank wall/bulkhead and torque-tighten the fasteners as detailed in the appropriate section of this topic.

(4) Apply sealants (PR1720F and PR1720SM) to the 'in fuel' side of the fasteners (Ref. Fig. 407). If both sides of the pipe joint are in fuel (same tank or different tanks), do not apply sealants to the fasteners.

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ENGINE FEED SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE PRECAUTIONS FOR ENTERING FUEL TANKS DETAILED IN 28-10-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00

1. General

This topic comprises the following procedures, under separate headings:

Operational Tests:

Engine Feed Pumps: Engine Feed Pump NRVs:
LP Isolation Valves: Cross-feed Valves.

Functional Test:

Accumulator and Bypass Valve.

Leakage Tests:

R Recirculation Pipes in Engine Bays: Engine Feed Pipe:
R Recirculation Pipe: Cross-feed Pipe: LP Isolation Valve.

NOTE: The Leakage Test of the LP Isolation Valve is required to be carried out after engine removal.

Flow Tests:

Main Feed Pipe: Cross-feed Pipe: Recirculation Pipe and Pressure Holding Valve: Accumulator Air Supply.

A System Test is not applicable.

The system control and indicators are grouped on the fuel management panel at the third crew member's station.

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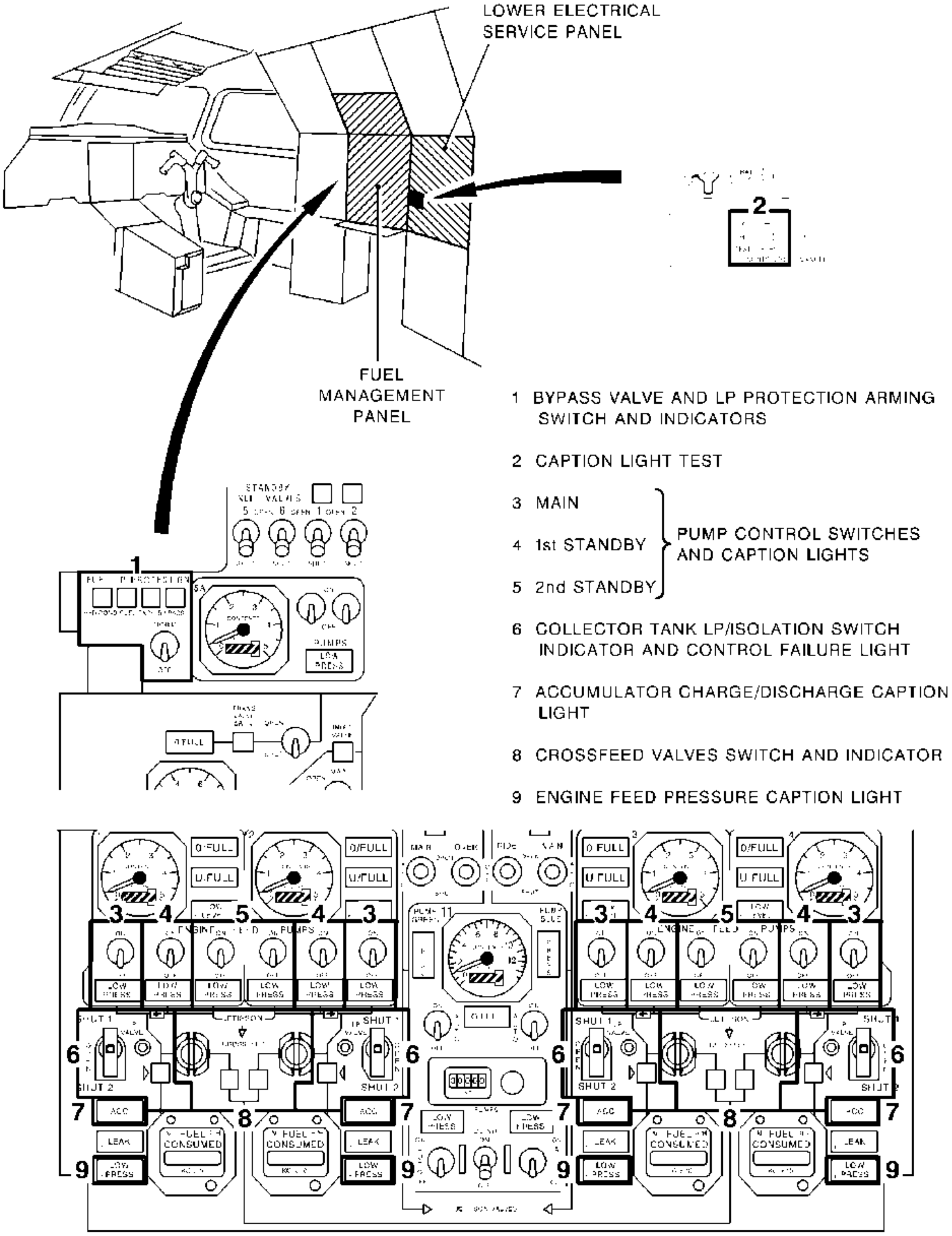

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Engine Feed Controls and Indicators
Figure 501

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2. Operational Test - Engine Feed Pumps (Ref. Fig.501)

A. Prepare to Test Engine Feed Pumps

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that there are at least 1,000 kg of fuel in each collector tank.

(4) Check that all engine feed pump LOW PRESS captions are illuminated.

B. Test Engine Feed Pumps

(1) Set all ENGINE FEED PUMP switches to "ON". Check that all associated LOW PRESS captions are extinguished within 3 s of the operation of the switches, indicating the correct build-up of pump pressure.

(2) Test the auto cut-out interaction by setting tanks 5 and 7 LH PUMP switches to "EMERG". Check that the 1st standby engine feed pump LOW PRESS captions for tanks 2 and 4 are illuminated.

(3) Set all PUMP switches to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

3. Operational Test - Engine Feed Pump NRVs

A. Prepare to Test Engine Feed Pump NRVs

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that tank 9 contains at least 1,000 kg of fuel.

(4) Record the fuel quantity in the collector tank, as shown on the fuel quantity indicator (FQI).

B. Test Engine Feed Pump NRVs

(1) Set the associated collector tank jettison valve switch to "OPEN".

(2) Set the associated LP VALVE switch to "SHUT 1".

(3) Set a tank 9 PUMP switch, on the same side as the collector tank, to "ON" for 5 min, then set the switch to "OFF".

(4) Check, by reference to the FQI, that the fuel transferred into the collector tank is not more than 30 kg.

NOTE: If the fuel transferred exceeds 30 kg, repeat the test after blanking the accumulator bleed, using the
R blanking tool/test adapter (Pt. No. E92507303C).
If, during this test, there is a steady increase in the tank FQI reading, this will indicate an excessive reverse flow through one or more of the engine feed pump NRVs.

(5) Set the collector tank jettison valve switch to "SHUT".

(6) Set the LP VALVE switch to "OPEN".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

4. Operational Test - LP Isolation Valves

A. Prepare to Test LP Isolation Valves

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Press the LIGHTS CTR test switch on the lower electrical services panel 6-214, and check that the LP VALVE failure indication lights (4 off) are illuminated (white). Release the test switch and check that the lights are extinguished.

(4) Check that the LP VALVE switch is set to OPEN and the magnetic indicator displays bar-in-line.

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B. Test LP Isolation Valve

(1) Set the LP VALVE switch to "SHUT 1" and check that the associated magnetic indicator displays diagonal stripes and then bar-across-line within 4 s of the operation of the switch.

(2) Set the LP VALVE switch to "OPEN" and check that the associated magnetic indicator displays diagonal stripes and then bar-in-line within 4 s of the operation of the switch.

(3) Set the LP VALVE switch to "SHUT 2" and check that the associated magnetic indicator displays diagonal stripes and then bar-across-line within 4 s of the operation of the switch.

(4) Trip the associated circuit breaker to simulate LP valve circuit failure and check that the failure indication light is on.

SERVICE	PANEL	CIRCUIT BREAKER		MAP REF.
ENG 1 LP VALVE SUP 2	16-215	1Q	2	-
ENG 2 LP VALVE SUP 2	15-215	2Q	2	C19
ENG 3 LP VALVE SUP 2	15-215	3Q	2	C20
ENG 4 LP VALVE SUP 2	16-215	4Q	2	-

(5) Reset the circuit breaker and check that the light is off.

(6) Set the LP VALVE switch to "OPEN" and check that the magnetic indicator displays diagonal stripes and then bar-in-line within 4 s of the operation of the switch.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

5. Operational Test - Cross-feed Valves

A. Prepare to Test Cross-feed Valves

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

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(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Check that the cross-feed valve magnetic indicator displays bar-across-line.

B. Test Cross-feed Valves

(1) Set the CROSS-FEED valve switch in-line with the flow line on the panel and check that the associated magnetic indicator displays diagonal stripes and then bar-in-line within 2 s of the operation of the switch.

(2) Set the switch across-line to the flow-line on the panel and check that the magnetic indicator displays diagonal stripes and then bar-across-line within 2 s of the operation of the switch.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

6. Functional Test - Accumulator and Bypass Valve (Ref. Fig.502)

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of supplying a pressure of 100 psig (6.895 bar)	-
Minilock coupling at the air supply hose-end	SAREM 711AB

B. Prepare to Test Accumulator and Bypass Valve

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the associated tank contains at least 1,000 kg of fuel.

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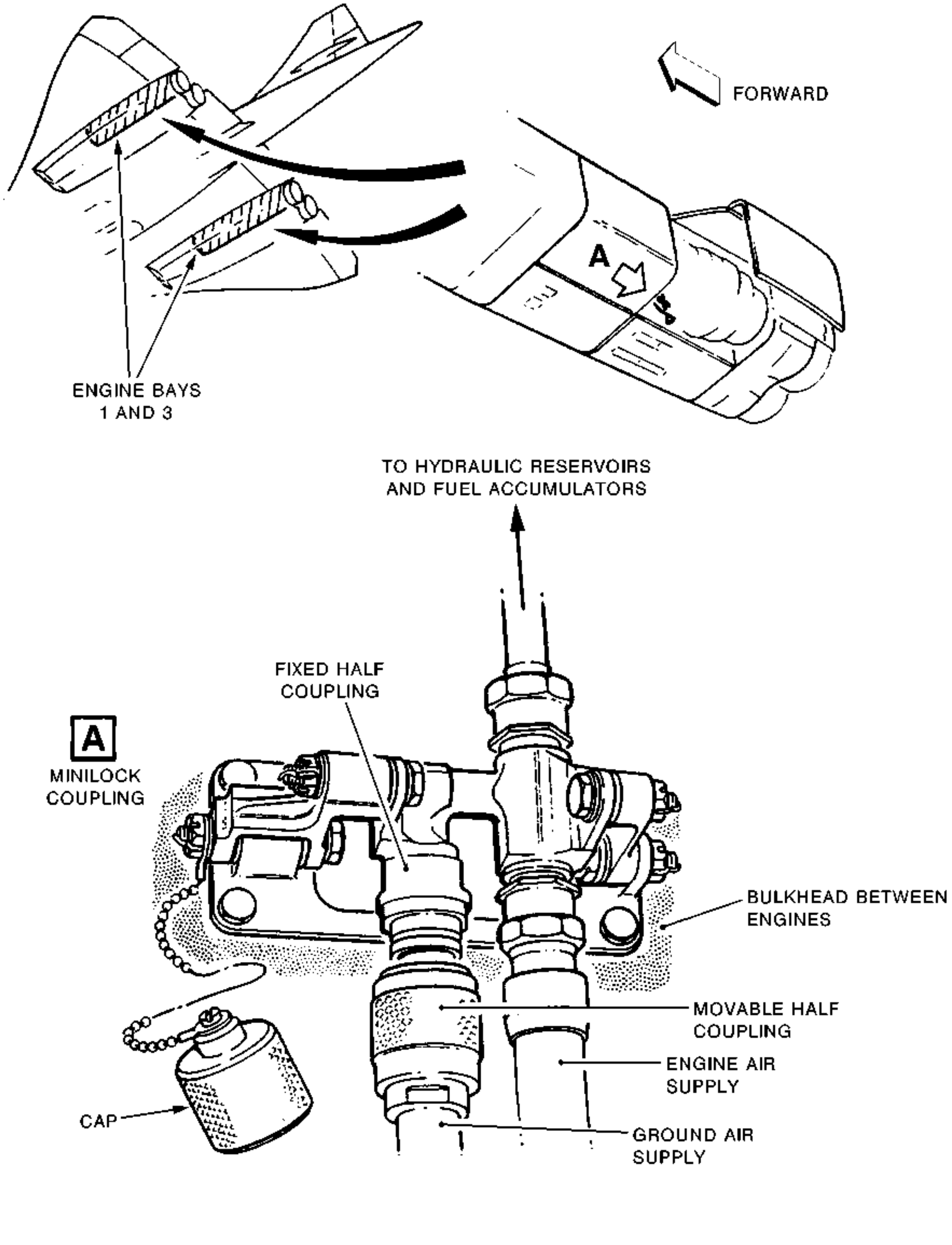

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Fuel/Hydraulic Ground Air Charging Minilock Coupling
Figure 502

(4) Open the appropriate (No.1 or No.3) engine bay rear door to the servicing position (Ref. 71-00-00, Servicing), to gain access to the fuel/hydraulic ground air charging (self-sealing) Minilock coupling (Ref. Fig.502).

(5) Remove the cap from the coupling and connect an air supply rig.

NOTE: An air pressure applied to the coupling in No.1 engine bay will pressurize the hydraulic reservoirs and tanks 1 and 2 accumulators. The coupling in No.3 engine bay is used to pressurize the hydraulic reservoirs and tanks 3 and 4 accumulators.

(6) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(7) Check that the ACC captions are illuminated.

C. Test Accumulator and Bypass Valve

(1) Set the ENGINE FEED PUMP switches for the appropriate collector tank to "ON". Check that the LOW PRESS captions are extinguished as pump pressure builds up.

(2) Check that the ACC captions remain illuminated.

(3) Operate the air supply rig and pressurize the accumulator air line to 80 psig (5.516 bar) and check that the appropriate ACC caption is extinguished.

(4) Set the FUEL LP PROTECTION switch to "ARMED".

(5) Set the ENGINE FEED PUMP switches to "OFF".

(6) Check that the ACC caption is illuminated and the FUEL LP PROTECTION magnetic indicator displays OPEN, indicating the operation of the bypass valve.

(7) After 30 s, set the appropriate ENGINE FEED PUMP switches to "ON" and check that the ACC caption is extinguished 2 to 3 s later, and the FUEL LP PROTECTION magnetic indicator display changes to black.

(8) Set the FUEL LP PROTECTION switch to "OFF".

(9) Set the ENGINE FEED PUMP switches to "OFF".

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D. Conclusion

(1) Release the air pressure at the supply rig. Disconnect the air supply line and refit the cap to the self-sealing coupling in the engine bay.

(2) Close the engine bay rear door (Ref. 71-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

7. Leakage Test - Recirculation Pipes in Engine Bays

NOTE: This test is applicable to the recirculation pipes between the engine connection and the recirculation NRV.

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A. Equipment and Materials

DESCRIPTION	PART NO.
Ground fuel pressure test rig	-
Recirculation pipe adapter, to connect recirculation pipe to rig supply line	E925111000
Pressure holding valve dummy element, fitted with on/off valve	E925101000
Torque spanner, 75 to 125 lbf in (0.847 to 1.412 mdaN)	-

B. Prepare to Test Recirculation Pipe

(1) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

(2) Open the forward engine door (Ref. 71-00-00, Servicing).

(3) Disconnect the recirculation flexible pipe from the engine (Ref. Fig.503).

NOTE: On Nos.1 and 3 engines the flexible pipe must be disconnected at the upper end of the engine-mounted pipe. On Nos.2 and 4 engines the flexible pipe must be disconnected from the union at the bracket.

(4) Fit the adapter to the recirculation flexible pipe and connect the ground fuel test rig inlet pipe to the adapter.

NOTE: There will be fuel spillage from the recirculation flexible pipe when it is disconnected. The rig must be connected to the pipe as quickly as possible in order to keep spillage to a minimum. There will be no loss of fuel from the engine side of the connection since, with electrical power off, the engine recirculation valve will be closed.

(5) Remove the recirculation pressure holding valve from its canister (Ref. 28-21-16) and in its place fit the dummy element.

C. Test Recirculation Pipe

(1) Operate the rig and gradually fill the pipe with fuel. Manipulate the dummy element to bleed air from the pipe.

(2) Pressurize the pipe to between 160 and 175 psig (11.032 and 12.066 bar). Maintain this pressure and visually check the system pipe couplings and components. No leakage is permitted.

D. Conclusion

(1) Release the pressure at the test rig and at the pressure holding valve dummy element. Disconnect the rig and adapter.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the recirculation flexible pipe and connect the pipe to the engine fitting. Torque-tighten the union nut to between 75 and 125 lbf in (0.847 and 1.412 mdaN) and wire-lock it in accordance with 20-21-13.

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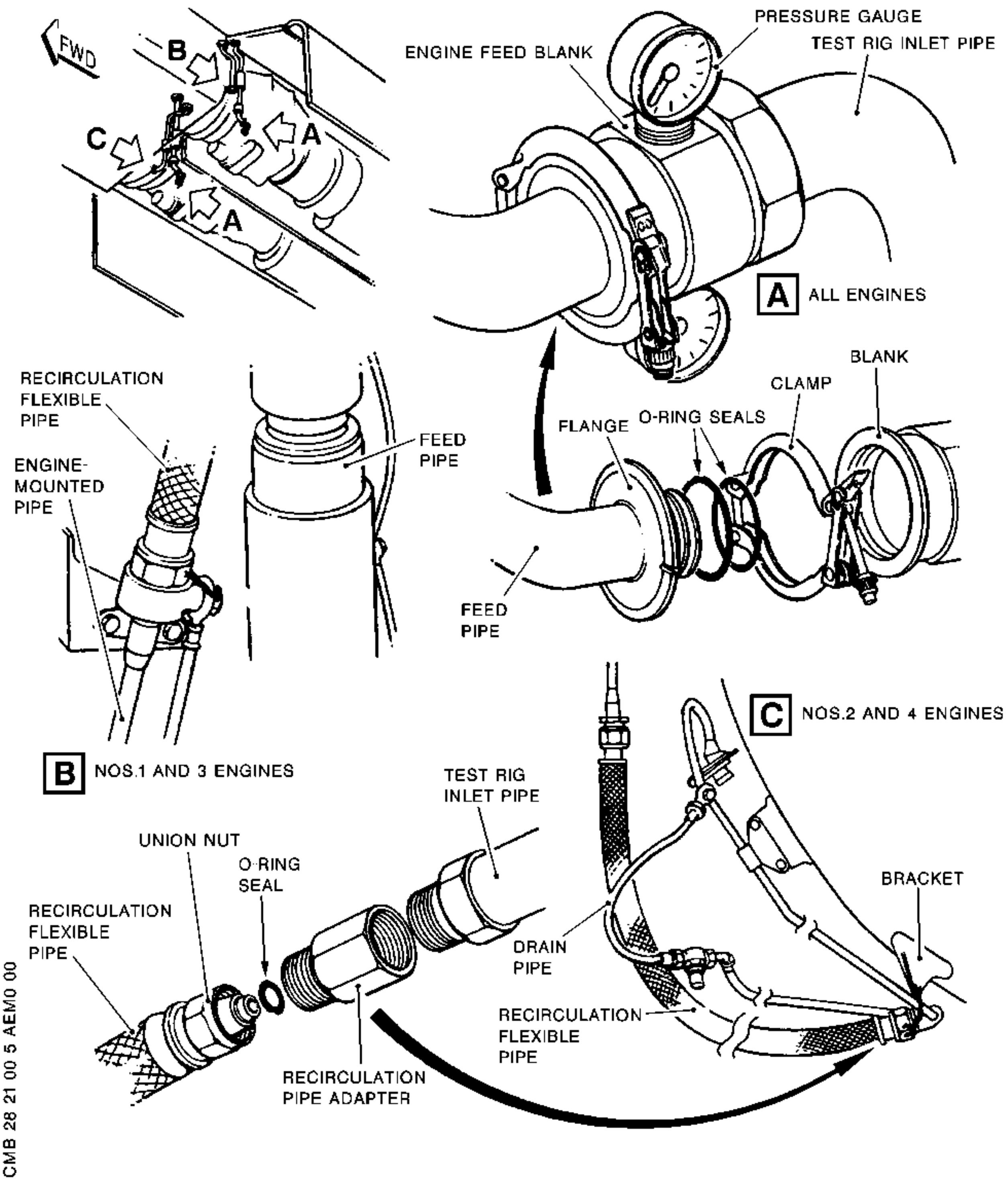

Main Feed and Recirculation Pipe Disconnect
Points on Engine
Figure 503

(3) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

R (4) Carry out a Leakage Test of the engine feed and recirculation pipe (Ref. para. 8. and 9.) to test the recirculation pipe joint at the engine.

R 8. <u>Leakage Test - Engine Feed Pipe</u>

<u>WARNING</u>: WHEN INSPECTING PIPES IN FUEL TANKS, OBSERVE ALL APPLICABLE TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

A. General

R (1) This test is applicable to all pipe joints in the engine feed system.

R

(2) If fuel pipe joints in the engine bays are under test, the pipe drains must be checked (Ref. 28-21-18) to ensure that no fuel is leaking into the pipe shrouds.

R

B. Equipment and Materials

R Nil

R C. Prepare to Test Engine Feed Pipe

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (3) Ensure that there are at least 2,000 kg of fuel in trim tank
R No.9.

R
R

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(4) Ensure that the cap on the associated engine feed drain valve is fitted (Ref. 28-21-42).

(5) Ensure that for the tank containing the pipework to be tested the following tanks are empty:

TANK UNDER TEST	TANKS TO BE EMPTY
Tank 1	Tanks 1, 5, 6
Tank 2	Tanks 2, 6
Tank 3	Tanks 3, 7
Tank 4	Tanks 4, 7, 8

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(6) Remove the appropriate access panel(s) to gain access to the pipe under test (Ref. 28-10-00, Servicing).

(7) At the fuel management panel, check that the associated LP VALVE switch is set to "SHUT" and the magnetic indicator displays bar-across-line.

(8) Set the associated CROSSFEED valve to "SHUT" (across-line).

(9) Set the associated collector tank JETTISON valve switch to "OPEN" and check that the magnetic indicator displays bar-in-line.

D. Test Engine Feed Pipework

WARNING: WHEN ENTERING A TANK OR INSPECTING THE PIPE, OBSERVE ALL THE APPLICABLE TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Pump fuel from a trim tank No.9 by setting a PUMP switch, associated with the open collector tank JETTISON valve, to "ON".

(2) Bleed engine feed pipes via the bleed valve on the associated fuel accumulator.

(3) Allow pump pressure to build up. Maintain this pressure for 15 min.

R (4) Using suitable protection (Ref. 28-00-00, Servicing) visually examine pipework, couplings and components for leaks. No leakage is permitted.

E. Conclusion

R (1) At the fuel management panel set PUMP switch to "OFF".

R (2) Set the associated collector tank JETTISON valve switch to "SHUT" and check that the magnetic indicator displays bar-across-line.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R (4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (5) Examine for freedom from corrosion the mating surfaces of the tank access panels that were removed in para. C.(7) for access. Fit the panels as detailed in 53-00-00 and 57-00-00.

R 9. Leakage Test - Recirculation Pipework

R A. General

R This test is applicable to all pipe joints in the recirculation systems.

R B. Prepare to Test Recirculation Pipework

R (1) Make available electrical ground power as detailed in 24-41-00, Servicing.

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(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that there are at least 2,000 kg of fuel in a trim tank No.9.

(4) Ensure that for the tank containing the pipework to be tested the following tanks are empty:

TANK UNDER TEST	TANKS TO BE EMPTY
Tank 1	Tanks 1, 5, 6
Tank 2	Tanks 2, 6
Tank 3	Tanks 3, 7
Tank 4	Tanks 4, 7, 8

(5) Remove the appropriate access panel(s) to gain access to the pipes under test (Ref. 28-10-00, Servicing).

(6) Remove the recirculation pressure holding valve element.

(7) At the fuel management panel, check that the associated LP VALVE switch is set to OPEN and the magnetic indicator displays bar-in-line.

(8) Set the associated cross-feed valve to "SHUT".

(9) Set the associated collector tank JETTISON valve switch to "OPEN" and check that the magnetic indicator displays bar-in-line.

C. Test Recirculation Pipework

WARNING: WHEN ENTERING A TANK OR INSPECTING THE PIPE, OBSERVE ALL THE APPLICABLE TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Pump fuel from a trim tank No.9 by setting an associated PUMP switch to "ON".

(2) Using suitable protection (Ref. 28-00-00, Servicing) visually examine pipework, couplings and components for leaks. No leakage is permitted.

NOTE: The air conditioning and hydraulic heat exchangers and the air conditioning heat exchanger fuel control valve must be checked for freedom from fuel leakage during this test (Ref. 21-00-00, Servicing and 29-11-00).

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D. Conclusion

(1) At the fuel management panel set PUMP switch to "OFF".

(2) Set the associated collector tank JETTISON valve switch to "SHUT" and check that the magnetic indicator displays bar-across-line.

(3) Refit re-circulation pressure holding valve element (Ref. 28-21-16, Removal/Installation).

(4) At the fuel management panel, check that the associated LP VALVE switch is set to "SHUT" and the magnetic indicator displays bar-across-line.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(6) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(7) Examine for freedom from corrosion the mating surfaces of the tank access panels that were removed in para. B.(5) for access. Fit the panels as detailed in 53-00-00 and 57-00-00.

(8) Carry out a test of the recirculation system pipework (Ref. 28-21-16, Adjustment/Test).

10. Leakage Test - Cross-feed Pipe

A. Prepare to Test Cross-feed Pipe

WARNING: WHEN ENTERING A TANK OR INSPECTING THE PIPE, OBSERVE ALL THE APPLICABLE TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Remove the appropriate access panel(s) to gain access to the pipe under test (Ref. 28-10-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

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(3) Ensure tanks with cross-feed pipework are empty (tanks 6 and 7).

(4) Ensure tank 4 is empty.

(5) On fuel management panel ensure that all CROSS-FEED valves are SHUT.

(6) Ensure that there are at least 2,000 kg of fuel in tank 9 to prime the system.

B. Test Cross-feed Pipe

(1) At the fuel management panel, check that No.1 LP VALVE switch is set to "SHUT" and the magnetic indicator displays bar-across-line.

(2) Set No.1 CROSS-FEED valve to "OPEN" (in-line).

(3) Set the No.1 collector tank JETTISON valve switch to "OPEN" and check that the magnetic indicator displays bar-in-line.

(4) Set tank 9 TRIM TRANSFER pump to "ON".

(5) Set tank 4 LP valve and CROSS-FEED valve to "OPEN" (in-line).

(6) When tank 4 shows signs of fuel increase set tank 4 LP valve and CROSS-FEED valve to "SHUT" (across-line).

(7) Using suitable protection (Ref. 28-00-00, Servicing) visually examine pipework and couplings for leaks. No leakage is permitted.

(8) Set tank 9 TRIM TRANSFER pump to "OFF".

C. Conclusion

(1) Set the No.1 CROSS-FEED valve to the shut position (across-line).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Examine for freedom from corrosion the mating surfaces of the tank access panels that were removed in para. A.(1) for access. Fit the panels as detailed in 53-00-00 and 57-00-00.

11. Leakage Test - LP Isolation Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Clean container, 5 gal (23 l), for fuel spillage	-

B. Prepare to Test LP Isolation Valve

NOTE: This test is required to be carried out following an engine removal (Ref. 71-00-12).

If a leakage test is required with the engine in position, the engine feed pipe must be disconnected at the engine connection (Ref. 71-00-12).

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure, by reference to the fuel quantity indicator, that the associated collector tank contains at least 1,000 kg of fuel.

(4) Remove the blank from the engine inlet connection and position a 5 gal (23 l) container to collect fuel spillage. Wait until the fuel flow stops.

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C. Test LP Isolation Valve

(1) At the fuel management panel, set the appropriate LP VALVE switch to "SHUT 2". Check that the associated magnetic indicator displays diagonal stripes and then bar-across-line.

(2) Set any one of the associated ENGINE FEED PUMP switches to "ON" and check that the LOW PRESS caption is extinguished as pump pressure builds up.

(3) In the engine bay, check that the fuel flow does not recommence and the leakage across the valve does not exceed 10 drops per minute over a period of 2 min.

(4) Set the ENGINE FEED PUMP switch to "OFF".

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D. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(2) Fit the blank to the engine inlet connection.

(3) Remove the container.

12. Flow Test - Main Feed Pipe

A. Equipment and Materials

DESCRIPTION	PART NO.
Ground fuel pressure test rig and engine fuel flow simulator	-
Engine feed blank	E925123000
Pressure gauge, 0 to 40 psi (0 to 2.758 bar)	-
Torque spanner, 47 to 57 lbf in (0.531 to 0.644 mdaN)	-

B. Prepare to Test Main Feed Pipe

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Refuel (Ref. 12-11-28) tanks 1, 2, 3 and 4 to approximately 75 percent of tank fuel capacity.

(4) Open the appropriate engine forward door (Ref. 71-00-00, Servicing).

(5) Disconnect the main feed pipe from the engine (Ref. Fig.503).

NOTE: The feed pipes to engines 2 and 4 can only be tested to the flow requirements when the engines are removed from the nacelles.

(6) Fit two new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe inlet connection.

(7) Secure the engine feed blank to the feed pipe flange with the clamp. Torque-tighten the clamp bolt to between 47 and 57 lbf in (0.531 and 0.644 mdaN).

(8) Remove the blanking cap and connect the test rig to the engine feed blank. Fit a 0 to 40 psi (0 to 2.758 bar) pressure gauge to the blank.

C. Test Main Feed Pipe

(1) Set a demand of 40,000 lb/h (18,144 kg/h) on the pressure and flow test rig.

(2) Set each of the associated ENGINE FEED PUMP switches, in turn, to "ON" and then to "OFF" after checking the individual pump flow.

(3) Check that each pump flow pressure, as indicated on the pressure gauge at the engine inlet connection, is 8(±2) psig (0.552(±0.138) bar).

(4) Set all the associated ENGINE FEED PUMP switches to "ON" and set a demand of 80,000 lb/h (36,288 kg/h) on the pressure and flow test rig. Check that the pressure indicated at the engine inlet connection is 2.9(+2) psig (0.2(+0.138) bar) for outboard engines and 3.7(+2) psig (0.255(+0.138) bar) for inboard engines.

(5) Set the ENGINE FEED PUMP switches to "OFF".

D. Conclusion

(1) Disconnect the rig and the engine feed blank.

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R (2) Remove the pressure gauge fitted at para. B.(8)

R (3) If required, fit two new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe inlet connection.

R (4) Secure the main feed pipe to the engine inlet connection with the clamp. Torque-tighten the clamp bolt to between 47 and 57 lbf in (0.531 and 0.644 mdaN).

R (5) Carry out a Leakage Test of the engine feed and recirculation pipe (Ref. para. 8. and 9.) to test the pipe joints at the engine.

R (6) Close the engine door opened in para. B.(4) (Ref. 71-00-00, Servicing).

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13. Flow Test - Cross-feed Pipe

A. Equipment and Materials

DESCRIPTION	PART NO.
Ground fuel pressure test rig and engine fuel flow simulator	-
Engine feed blank	E925123000
Pressure gauges, -10 to +40 psi (-0.689 to +2.758 bar)	-

B. Prepare to Test Cross-feed Pipe

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Refuel (Ref. 12-11-28) tanks 1, 2, 3 and 4 to approximately 75 percent of tank fuel capacity.

(4) Open the appropriate engine forward door (Ref. 71-00-00, Servicing).

(5) Disconnect the main feed pipe from No.1 engine (Ref. Fig. 503).

(6) Fit two new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe inlet connection.

(7) Secure the engine feed blank to the feed pipe flange with the clamp. Torque-tighten the clamp bolt to between 47 and 57 lbf in (0.531 and 0.644 mdaN).

(8) Remove the blanking cap and connect the test rig to the engine feed blank. Fit to the blank one or two pressure gauges, capable of measuring between -10 and +40 psig (-0.689 and +2.758 bar).

C. Test Cross-feed Pipe

(1) Set the CROSS-FEED valve switches for tanks 1 and 4 to the open (in-line) position and all ENGINE FEED PUMP switches for tank 4 to "ON".

(2) Set the fuel pressure and flow rig demand to 66,000 lb/h (29,940 kg/h) and check that the pressure indicated at the engine inlet connection is 0(±2) psig (0(±0.138) bar).

(3) Set the CROSS-FEED valve switches to the shut (across-line) position and the ENGINE FEED PUMP switches to "OFF".

(4) Set the CROSS-FEED valve switches for tanks 1 and 3 to the open (in-line) position and all ENGINE FEED PUMP switches for tank 3 to "ON".

(5) Repeat operations (2) and (3).

(6) Set the CROSS-FEED valve switches for tanks 1 and 2 to the open (in-line) position and all ENGINE FEED PUMP switches for tank 2 to "ON".

(7) Repeat operations (2) and (3).

D. Conclusion

(1) Disconnect the rig and the engine feed blank.

(2) Remove the pressure gauge fitted at para. B.(8).

(3) If required, fit two new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe inlet connection.

(4) Reconnect the main feed pipe to the engine inlet connection and secure with the clamp. Torque-tighten the clamp bolt to between 47 and 57 lbf in (0.531 and 0.644 mdaN).

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(5) Carry out a Leakage Test of the engine feed and
R recirculation pipe (Ref. para. 8. and 9.) to test the pipe joints at the engine.

(6) Close the engine door opened in para. B.(4) (Ref. 71-00-00, Servicing).

14. Flow Test - Recirculation Pipe and Pressure Holding Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Ground fuel pressure test rig	-
Recirculation pipe adapter	D925111000
Torque spanner, 75 to 125 lbf in (0.847 to 1.412 mdaN)	-

B. Prepare to Test Recirculation Pipe and Pressure Holding Valve

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Refuel (Ref. 12-11-28) tanks 1, 2, 3 and 4 to approximately 75 percent of tank fuel capacity.

(4) Open the appropriate engine forward door (Ref. 71-00-00, Servicing).

(5) Disconnect the recirculation pipe and fit the adapter to the hose end (Ref. Fig.503).

(6) Connect the test rig to the adapter.

C. Test Recirculation Pipe and Pressure Holding Valve

(1) Gradually apply a pressure of 7 psig (0.483 bar). Check the opening of the pressure holding valve, indicated by a hesitation in the gradual increase of pressure, occurring between 3.7 and 6.2 psig (0.255 and 0.427 bar).

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(2) Increase the pressure to 100 psig (6.895 bar). Check, by reference to the fuel quantity indicator, that the quantity of fuel transferred to the associated tank, in a 5 min period, is greater than 110 kg for systems 2, 3 and 4, or 120 kg for system 1.

D. Conclusion

(1) Release the pressure and disconnect the adapter and rig from the hose end.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the recirculation flexible pipe and connect the pipe to the engine fitting. Torque-tighten the union nut to between 75 and 125 lbf in (0.847 and 1.412 mdaN) and wire-lock it in accordance with 20-21-13.

R (3) Carry out a Leakage Test of the engine feed and recirculation pipe (Ref. para. 8. and 9.) to test the pipe joints at the engine.

(4) Close the engine door opened in para. B.(4) (Ref. 71-00-00, Servicing).

15. <u>Flow Test - Accumulator Air Supply</u> (Ref. Fig.504 and 505)

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing a minimum airflow of 10 scfm* at 80 psi (5.516 bar)	-
Pressure gauges (2), 0 to 40 psi (0 to 2.758 bar)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
*Standard cubic feet per minute	

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B. Prepare to Test Accumulator Air Supply

NOTE: In order to meet the full airflow requirements of this test, use is made of the common ground air charging point provided on each engine to pressurize the fuel and hydraulic systems. The connection and blanking cap are located on the hydraulic tank pressurization (HTP) coupling (Ref. Fig.505). With the air supply rig connected to one HTP coupling, both fuel accumulators on the same side will be pressurized.

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(2) Open the appropriate engine bay door to the servicing position (Ref. 71-00-00, Servicing).

(3) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(4) Remove the blanking cap from the HTP coupling on the engine of the system under test. Connect the ground air supply rig to the pipe connector.

(5) Remove the access panels in the wing fillet below the appropriate collector tanks (Ref. Fig.504) to gain access to the air control units.

(6) Disconnect the pressure switch tappings at the outlet of each air control unit (Ref. Fig.504) and install a 0 to 40 psi (0 to 2.758 bar) pressure gauge at both tappings.

C. Test Accumulator Air Supply

(1) Switch on the air supply and increase the pressure at the connection to the aircraft system to between 80 and 130 psig (5.516 and 8.963 bar).

(2) Check that each pressure gauge at the air control unit outlets indicates between 13.5 and 15.5 psig (0.931 and 1.069 bar).

(3) Switch off the air supply and exhaust the air from the system.

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(4) Remove the drain plug from each of the accumulators under test (Ref. Fig.504).

(5) Switch on the air supply and increase the pressure at the connection to the aircraft to a maximum of 130 psig (8.963 bar).

(6) Check that each pressure gauge at the air control unit outlets indicates at least 6.0 psig (0.414 bar) and that their readings do not differ by more than 1 psig (0.069 bar).

D. Conclusion

(1) Release the air pressure and remove the pressure gauges from the air control unit outlets and reconnect the pressure switch tappings. Torque-tighten the union nuts to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(2) Refit the accumulator drain plugs.

(3) Disconnect the ground air supply pipe. Refit and wire-lock the blanking cap to the HTP coupling.

(4) Close the engine bay doors (Ref. 71-00-00, Servicing).

(5) Remove the warning placard from the fuel management panel.

(6) Carry out a Leakage Test of the disturbed pipe connections at the air control units (Ref. 28-21-12, Adjustment/Test).

(7) Refit wing fillet access panels removed in para. B.(5).

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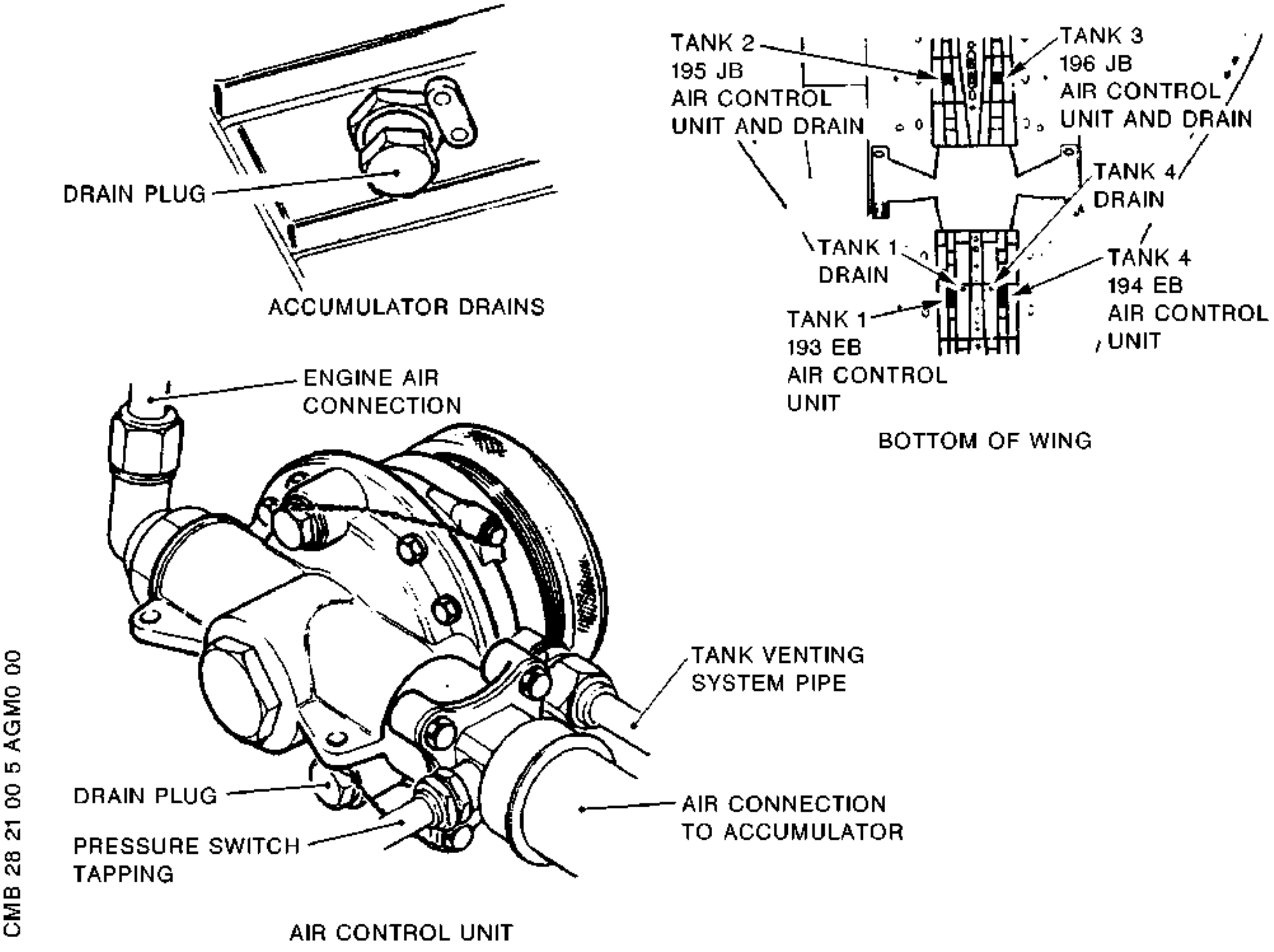
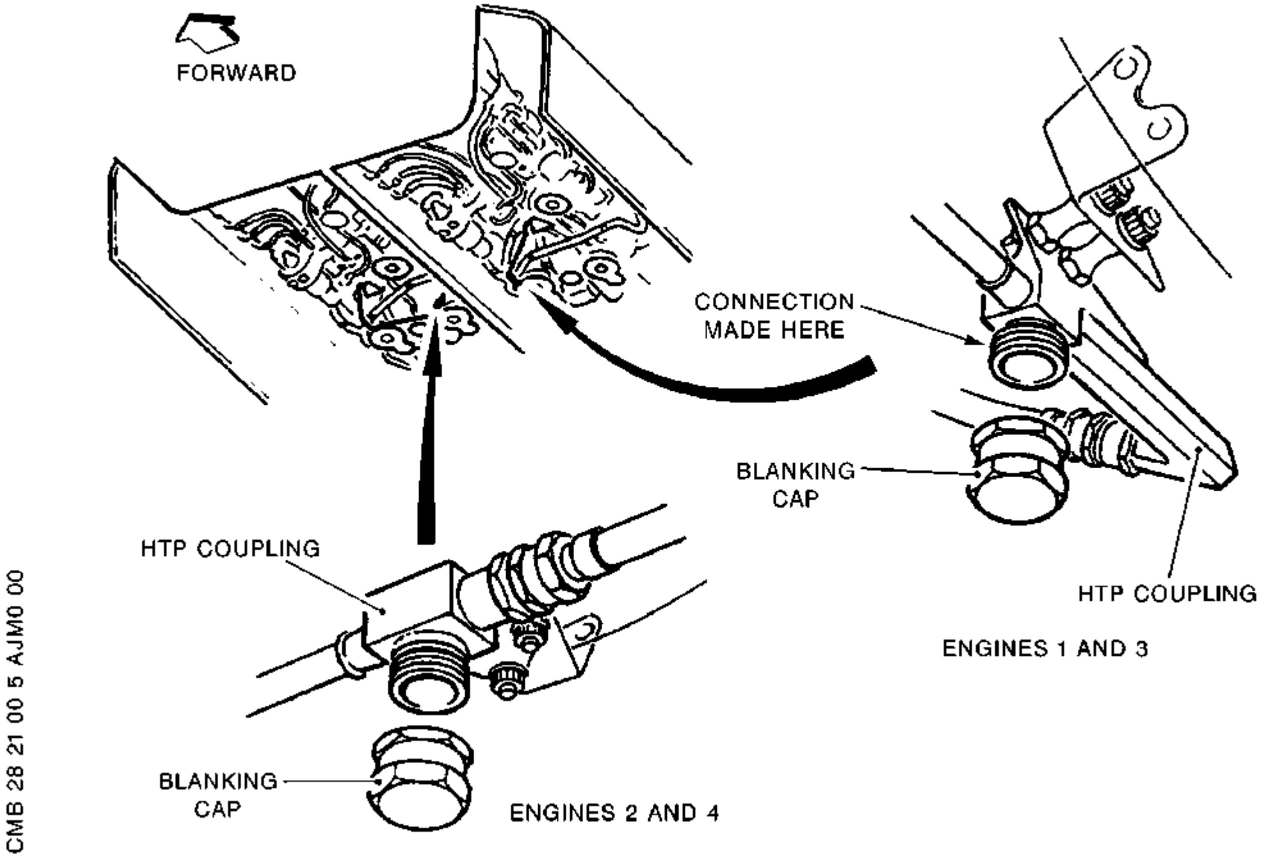


Air Control Unit and Accumulator Drains - Location
Figure 504



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Fuel/Hydraulic Ground Air Charging HTP Coupling
Figure 505

ENGINE FEED SYSTEM - APPROVED REPAIRS

R NOTE: When manufacturing new pipes, L.56 is an approved
R alternative for AG.3 material.

1. Repair Scheme 28-41258

A. RS 28-41258. Applies to Fuel Pipes.

PART NUMBER	IPC 28-21-40 FIG	- ITEM
E74068700200	10	150
E74068800200	13	150
E74068900200	10	90
E74069000200	13	90
E74069100200	19	90
E74069200100	10	290
E74069300300	19	310
E74069400099	9	10
E74069500200	15	20
E74069600200	18	20
E74069700100	12	20
E74070100200	11	190
E74071100000	9	110
E74072400200	8	360
E74072400300	17	410
E74073600100	17	240

B. The pipes listed above may be subjected to a once only removal of smooth dents provided no individual dent is more than 0.25" deep or extends around more than a quarter of the pipe circumference.

C. Pipes with sharp edged dents and kinks are not acceptable for repair.

D. On completion of repair, pipes should be subjected to dye penetrant crack detection, and a pressure test of 100 psi.

E. On satisfactory completion of repair and testing, identify pipe with R.S. 28-41258 painted adjacent to pipe part number.

NOTE: Pipe material is stainless steel spec Z10CNT18 which is equivalent to BSS 521.

2. Repair Scheme 28-41271

A. R.S. 28-41271. Applies to Fuel Pipes in Zones 531/532 and 631/632

PART NUMBERS	IPC 28-21-40 FIG	- ITEM
E74070000240 to E74070001800 incl.	8	17

B. The above pipes may be subjected to a once only removal of smooth dents, using standard practices, provided no individual dent is more than 0.15" deep or extends around more than a quarter of the pipe circumference.

C. Pipes with sharp edged dents and kinks are not acceptable for repair.

D. On completion of repair, pipes should be subjected to dye penetrant crack detection, and a pressure test of 100 p.s.i.

E. On satisfactory completion of repair and testing. identify pipe with RS 28-41271 painted adjacent to pipe part number.

<u>NOTE</u>: Pipe material is stainless steel Z3CN18 or Z10CNT18.

END OF THIS SECTION

NEXT

ACCUMULATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The accumulators, one for each of the four engine feed systems, are located in the associated Nos. 1, 2, 3 and 4 collector tanks. Each accumulator is secured to the upper surface of the tank and is connected to fuel feed and air pressurization pipes. For removal, the appropriate collector tank must be drained. The accumulator must be partially disassembled in situ, some parts being withdrawn through the accumulator cover plate aperture on the wing top surface, and some through a longer elliptical panel aperture in the wing lower surface.

Removal and installation instructions are also given for the accumulator diaphragm, and accumulator non-return valve, since these items can be removed without removing the accumulator from the aircraft.

Instructions for the removal and installation of the bonded seals in the accumulator covers are given in paragraph 5.

2. Accumulator

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel drain equipment, engine feed pipe	D925377000
Circuit breaker safety clips	-
Extractor and assembly tool, inner cover plate	E925072000
Extractor and assembly tool, inner casing	E925070000
Air supply rig, to produce 10 psig (0.689 bar)	-
Torque spanner, 35 lbf in (0.395 mdaN)	-

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DESCRIPTION	PART NO.
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Torque spanner with (Torq-set) adapter, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 75 to 84 lbf in (0.847 to 0.949 mdaN)	-
Torque spanner, 110 lbf in (1.141 mdaN)	-
Torque spanner, 145 lbf in (1.638 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Torque spanner, 307 to 317 lbf in (3.469 to 3.582 mdaN)	-
Torque spanner, 370 lbf in (4.181 mdaN)	-
Receptacle, for fuel drainage	-
Rubber-backed mats, to protect tank floor	-
RB Eurotwill cloth	-

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B. Prepare to Remove Accumulator

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(2) Defuel and drain the collector tank in which the accumulator is fitted (Ref. 28-25-00, Servicing).

(3) Electrically isolate the engine feed pumps in the collector tank by tripping the appropriate circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 MAIN PUMP SUP	1-213	1Q 834	J 3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q 835	F 5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q 836	D 1
TANK 2 MAIN PUMP SUP	1-213	2Q 834	L 3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q 835	B 5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q 836	F 4
TANK 3 MAIN PUMP SUP	1-213	3Q 834	N 3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q 835	A 8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q 836	G14
TANK 4 MAIN PUMP SUP	1-213	4Q 834	Q 3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q 835	F 8
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q 836	G16

(4) Isolate the electrical supply to the appropriate engine air starter motor by tripping the associated circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 & 4 AIR START CONT	15-215	K 181	C15
ENG 2 & 3 AIR START CONT	15-216	K 182	D11

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(5) Place a suitable warning placard on the engine starting panel, indicating that the engine must not be run.

(6) If required, empty the fuel from the bag formed by the flexible diaphragm of the accumulator, as follows:

(a) Ensure fuel has been drained from the engine feed pipe (Ref. 28-21-00, Servicing)

(b) Open the appropriate engine bay rear door (Ref. 71-00-00, Servicing) and connect an air supply rig to the ground air charging (self-sealing) Minilock coupling in the engine bay (Ref. 28-21-00, Adjustment/Test).

(c) Apply to the coupling, an air pressure of 10 psig (0.689 bar), which will cause the bag to invert and discharge its contents into the engine feed pipe.

(d) Release the air pressure at the supply rig. Disconnect the air supply line and refit the cap to the self-sealing coupling.

(e) Close the engine bay rear door (Ref. 71-00-00, Servicing).

(7) Position a suitable receptacle to collect fuel drainage and remove the plug from the accumulator drain (Ref. Fig. 401). Check that the drain is free of fuel. Refit the drain plug.

NOTE: A continuous flow of fuel from the drain would indicate a damaged diaphragm. In this case, provision should be made to drain all the fuel (5.25 gal (23.867 l)) from the accumulator.

(8) Drain the fuel from the engine feed pipe (Ref. 28-21-00 Servicing).

(9) Remove the appropriate access panel from the bottom surface of the wing to gain access to the accumulator to be removed (Ref. Fig.403).

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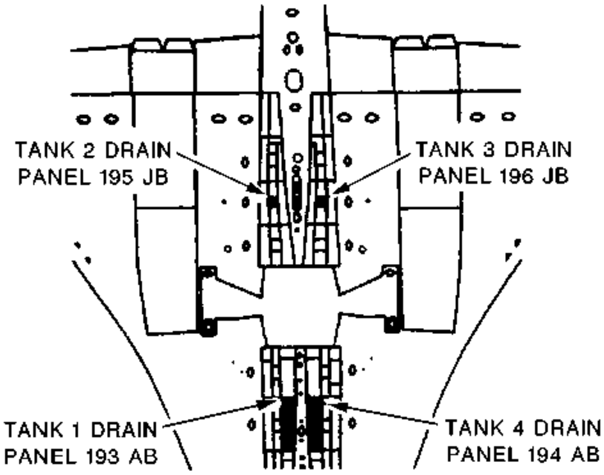
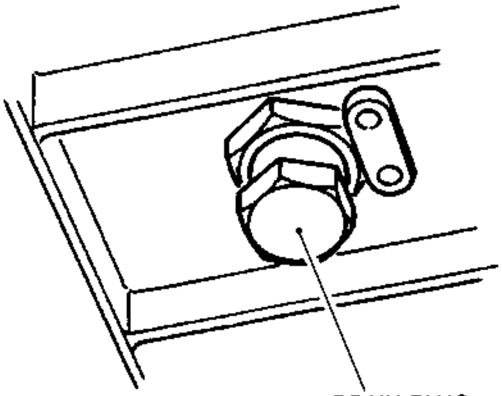


BOTTOM OF WING
(LOCATION OF DRAIN PLUGS)



Accumulator Drains
Figure 401

C. Remove Accumulator

(1) Remove the outer cover (Ref. Fig.402) as follows:

(a) Remove the four countersunk-head screws that retain the centre cover and remove it from the outer cover.

(b) Unscrew the sixteen captive screws securing the outer cover and extract the cover from the wing surface.

(2) Remove the inner cover (Ref. Fig. 402) as follows:

(a) Loosen the bolts that secure the four locking segments and disengage the segments from the groove in the housing. Lightly tighten a bolt in each segment to secure it in the retracted position.

(b) Assemble the appropriate extractor tool to the inner cover and, using the extractor, carefully withdraw the inner cover through the wing aperture.

(c) Remove the cover from the tool.

(3) Remove the inner casing (Ref. Fig.404) as follows:

(a) Loosen the bolts securing the four inner casing locking segments, and disengage the segments from the housing. Lightly retighten one bolt per segment to secure it in the disengaged position.

(b) Assemble the appropriate extractor tool to the inner casing:

b1) Secure the spider to the inner casing.

b2) Orientate and fit the ring into the housing, and fit the three locking segments on the ring into the upper groove in the housing. Secure the segments with bolts.

b3) Mount and secure the control arm assembly on the ring.

b4) Screw in the control arm until it bottoms in the spider and secure it with the screwed bush.

(c) Turn the control arm of the extractor tool counter-clockwise to withdraw the inner casing from the outer casing.

(d) Slacken the bolts securing the locking segments and retract them from the housing groove. Withdraw the inner casing complete with extractor tool through the cover plate aperture.

(e) Dismantle the extractor tool from the casing.

(f) Remove and discard the O-ring seals from the casing.

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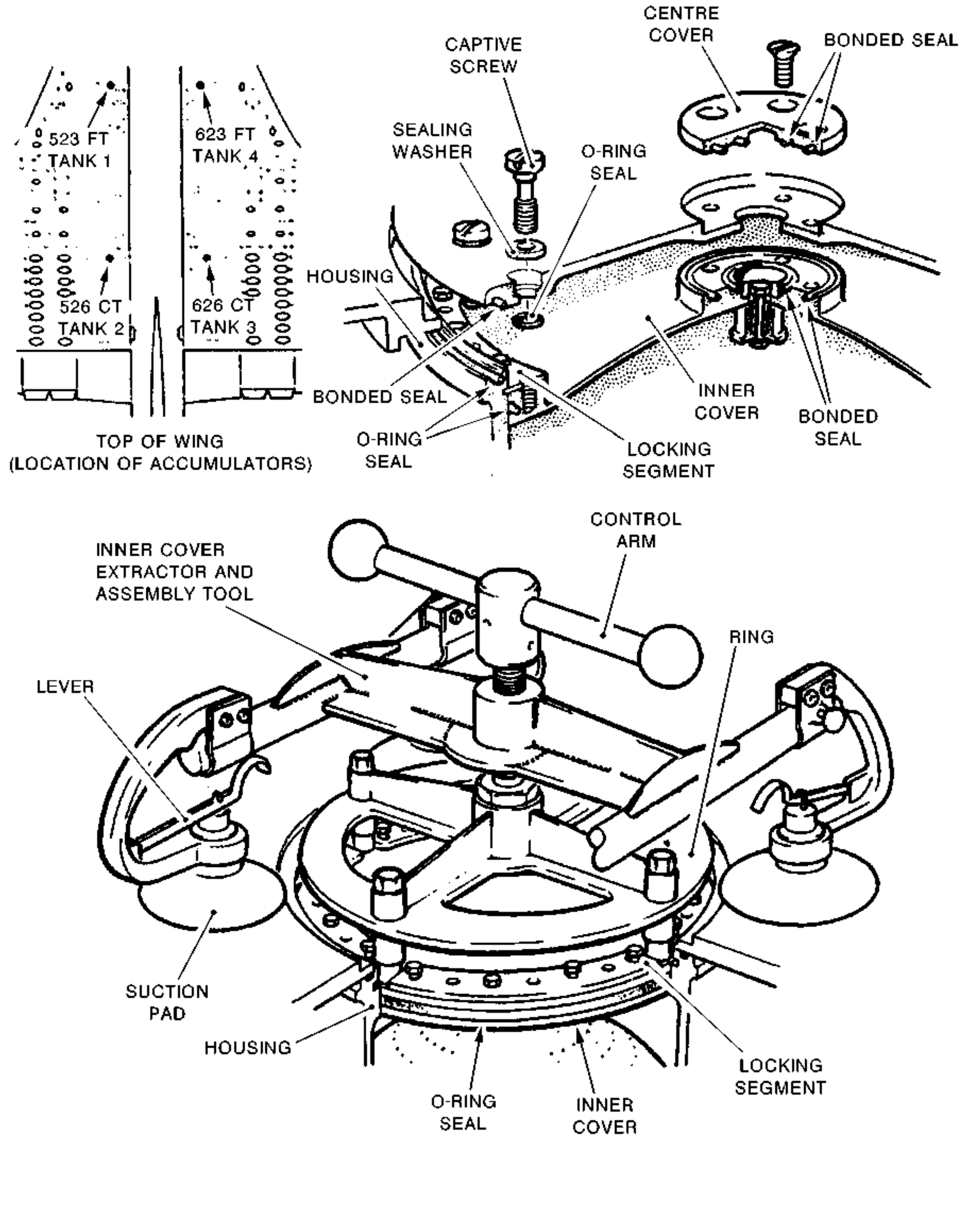
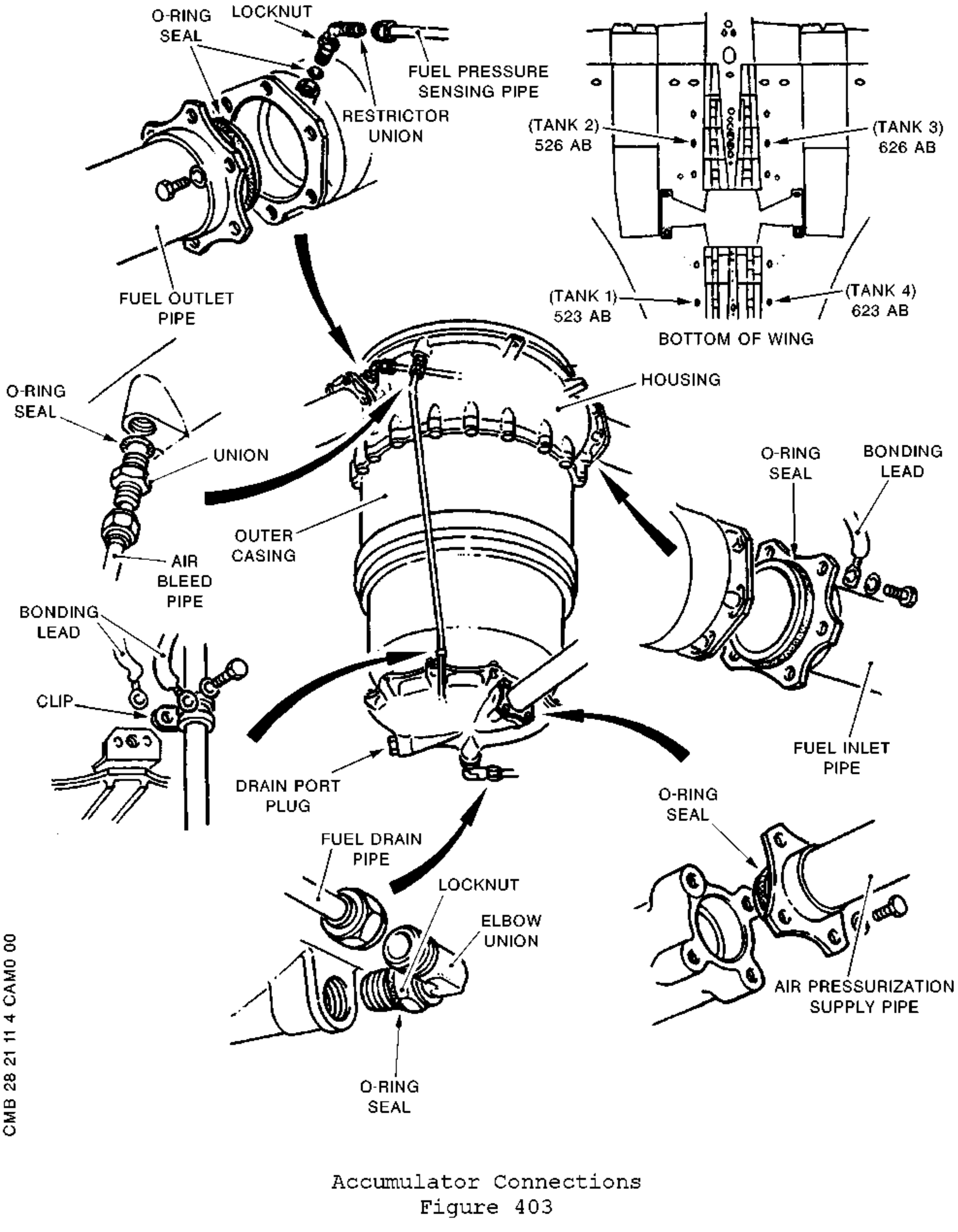


Outer and Inner Covers - Installation
Figure 402



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Accumulator Connections
Figure 403

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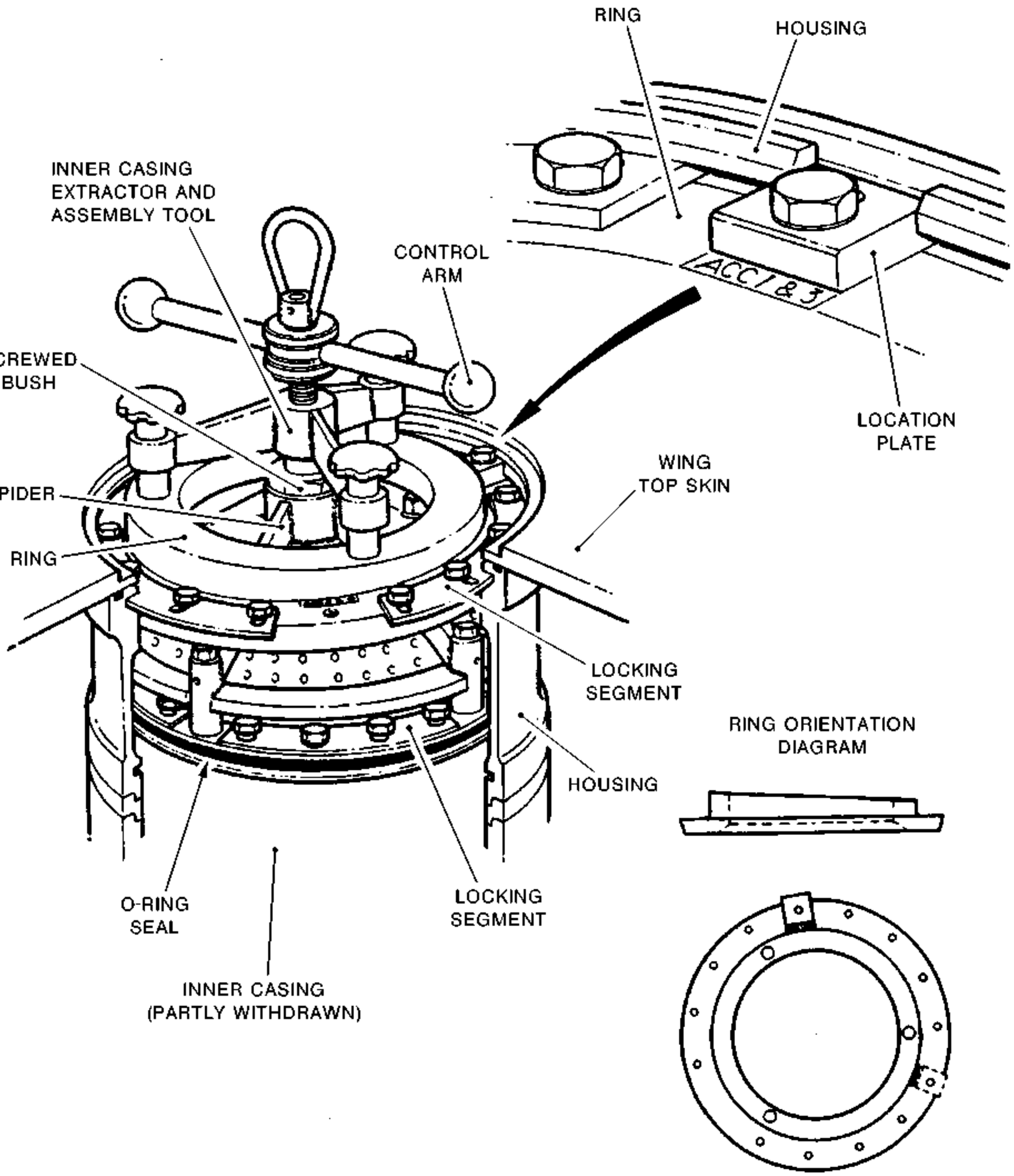

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Inner Casing - Installation
Figure 404

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(4) From within the tank, gain access to the accumulator, (Ref. Fig.403) removing the removable tank structure struts as necessary (Ref. 57-10-00, Description and Operation).

(5) Remove the air bleed pipe and disconnect the fuel pressure sense, fuel outlet, fuel inlet, fuel drain and air pressurization pipes from the accumulator.

(6) Remove the housing and outer casing assembly as follows:

(a) Remove the four bolts and nuts securing the housing to the wing top skin (Ref. Fig.405). Remove and discard the O-ring seals. Retain and identify each of the four bushes according to its attachment position.

NOTE: During installation, each bush must be fitted at the position noted during removal.

(7) Remove the outer casing from the housing by cutting the locking wire and removing the eighteen attachment bolts and washers securing the two semi-circular clamp rings to the housing. Place the casing on the floor of the tank (Ref. Fig.405).

(8) Remove the housing through the panel aperture in the bottom of the tank, and from the housing remove the pressure sensing pipe restrictor union and the air bleed pipe union.

(9) Remove the outer casing through the cover plate aperture in the top of the tank, and from the casing remove the drain pipe elbow union and the drain port plug (Ref. Fig.403).

(10) Fit suitable blanks to all apertures and open pipe ends.

D. Prepare to Install Accumulator

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the apertures and open pipe ends.

(3) During installation, all O-ring seals must be lubricated in accordance with 20-23-11.

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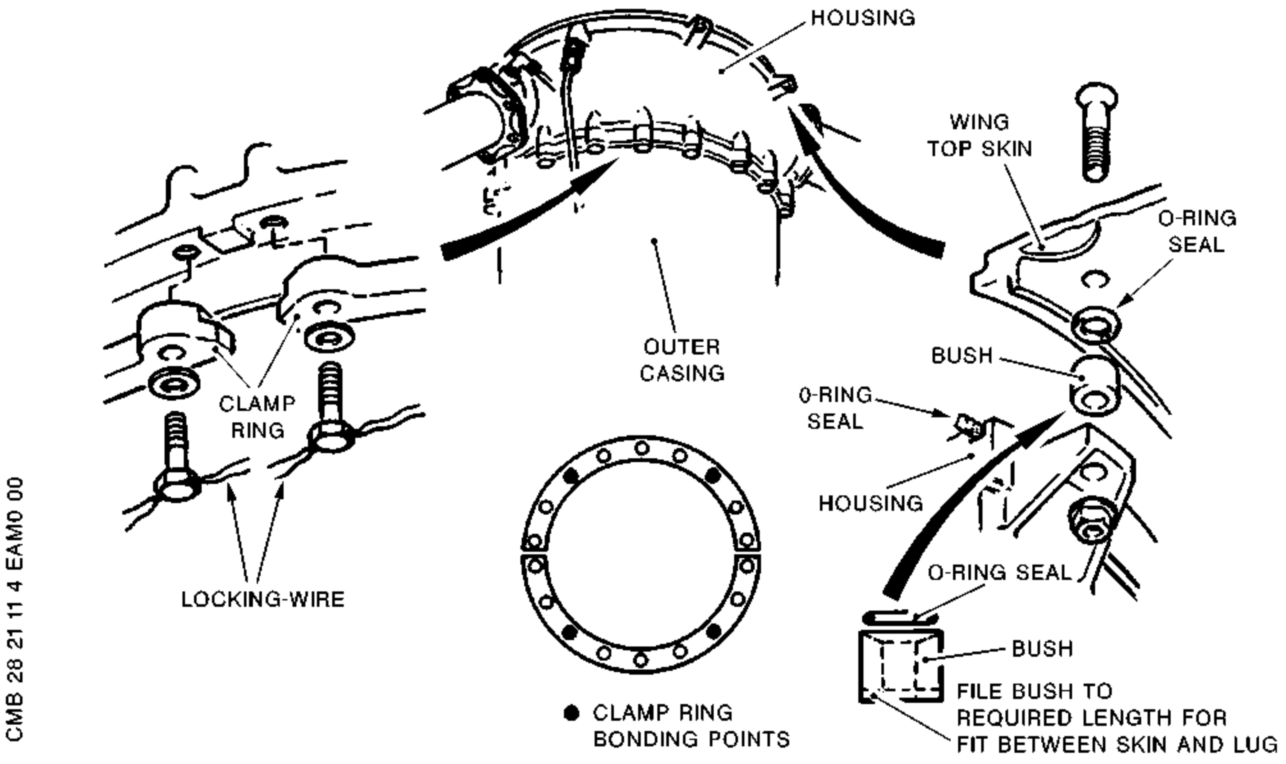

Assembly of Housing and Outer Casing
Figure 405

(4) Prepare the outer casing (Ref. Fig.403) as follows:

(a) Fit the fuel drain pipe elbow union and locknut together with a new O-ring seal to the appropriate drain port in the bottom of the casing (Ref. Fig.406). Torque-tighten the locknut to 370 lbf in (4.181 mdaN).

(b) Fit the drain port plug with a new O-ring seal to the alternative drain port. Torque-tighten the plug to between 307 and 317 lbf in (3.469 and 3.582 mdaN).

(c) Insert the outer casing through the cover plate aperture and place it temporarily on the floor of the tank interior.

NOTE: This must be done before the installation of the housing, which would prevent entry of the casing.

E. Install Accumulator

(1) Install the housing and outer casing as follows:

(a) Fit the pressure sensing restrictor union locknut, together with a new O-ring seal, to the housing. Torque-tighten the locknut to 110 lbf in (1.141 mdaN) (Ref. Fig.403).

(b) Fit the air bleed pipe union, together with a new O-ring seal, to the housing. Torque-tighten the union to 145 lbf in (1.638 mdaN).

(c) Fit a new O-ring seal to the housing.

(d) Insert the housing through the elliptical panel aperture in the bottom surface of the wing.

(e) If it is necessary to renew the bushes at the four attachment lug positions on the housing (Ref. Fig.405), proceed as follows:

e1) Secure the housing to the wing top skin, using the four bolts and nuts only. Torque-tighten the nuts to between 75 and 84 lbf in (0.847 and 0.949 mdaN).

e2) Measure each individual gap between the top face of the attachment lug and the underside of the wing top skin.

e3) File the base of each bush so that the bush fits exactly into the individual gap measured in operation e2).

NOTE: The chamfered end of the bush must not be filed, as this end, when the bush is installed, faces upward and forms a recess for the O-ring seal.

e4) Identify each bush according to its attachment position and restore its protective treatment in accordance with 20-24-32.

e5) Remove the four bolts and nuts securing the housing to the wing top skin. Place the housing temporarily on the floor of the tank interior.

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(f) Inside the tank, fit the outer casing to the housing, orientating it to align correctly (Ref. Fig.406). Fit the clamp rings and secure them with bolts and washers, tightening the bolts evenly and progressively. Ensure that the bonding bolts are positioned at the correct bonding points (Ref. Fig.405). Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904) and wire-lock them in accordance with 20-21-13.

(g) Position the outer casing and housing assembly, orientating it to align correctly (Ref. Fig.406) and secure it to the wing top skin, using the four bolts and nuts with the bushes and new O-ring seals positioned correctly.

NOTE: Each bush must be fitted at the position noted during removal. The chamfered end of the bush faces upward, forming a recess for the O-ring seal (Ref. Fig.405).

(h) Torque-tighten the nuts to between 75 and 84 lbf in (0.847 and 0.949 mdaN).

(j) Check that the gap between the periphery at the top of the housing and the underside of the wing top skin is between 0.00 and 0.015 in (0.00 and 0.38 mm).

(2) Connect the pipes to the accumulator (Ref. Fig.403) as follows:

(a) Fit a new O-ring seal to the fuel inlet pipe. Insert the pipe in the fuel inlet and secure it, using the six bolts and lock-washers. Fasten the bonding lead beneath the bolt with the dimpled head. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(b) Fit a new O-ring seal to the fuel outlet pipe. Insert the pipe in the fuel outlet and secure it with six bolts and washers, ensuring that the bonding bolt is correctly positioned. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(c) Fit a new O-ring seal to the air pressurization supply pipe. Insert the pipe in the accumulator air inlet and secure it with four bolts and washers. Torque-tighten the bolts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

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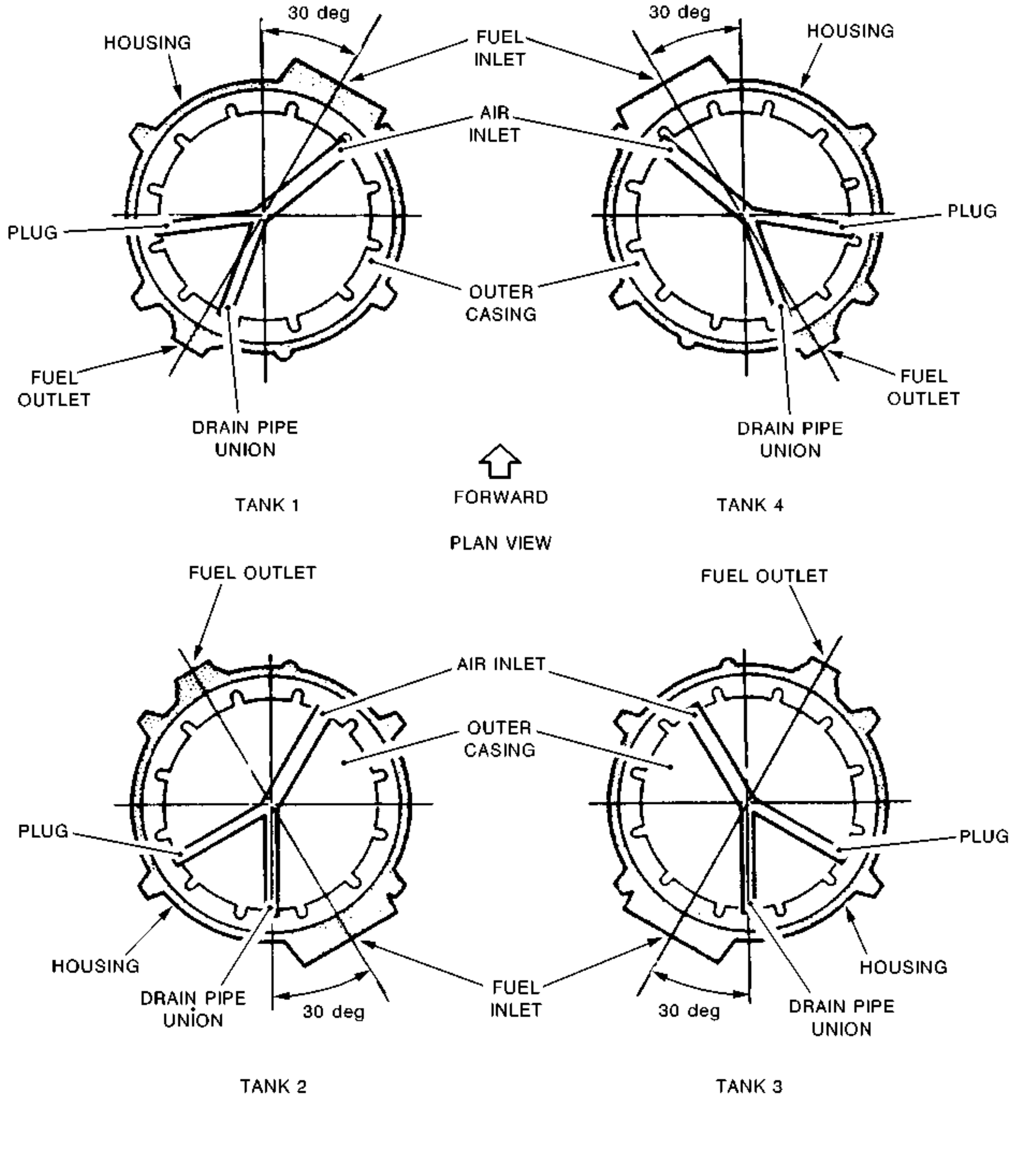

Orientation Diagram of Accumulator Sections
Figure 406

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(d) Connect the fuel pressure sensing pipe. Torque-tighten the coupling nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(e) Connect the drain pipe and torque-tighten the coupling nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(f) Connect the air bleed pipe to the union on the housing. Torque-tighten the coupling nut to between 60 and 80 lbf in (0.678 and 0.904 mdaN), and the pipe clip bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(3) Install the inner casing and diaphragm as follows:

(a) Fit new O-ring seals to the inner casing.

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(b) Clean the inner surface of the outer casing with clean
RB Eurotwill cloth.

(c) Position the diaphragm so that it rests in the inner casing, and check that its surface (air side) is clean.

(d) Insert the inner casing through the cover plate aperture into the support ring.

(e) Assemble the inner casing extractor tool (Ref. Fig. 404). Turn the control arm of the tool clockwise to push the casing into position. Lock the casing with the segments and secure them with bolts and washers. Torque-tighten the bolts to between 75 and 84 lbf in (0.847 and 0.949 mdaN).

(f) Remove the casing extractor tool.

(4) Install the inner cover (Ref. Fig.402) as follows:

(a) Ensure that the inner cover and its two bonded seals are clean and undamaged. If required, fit new bonded seals as detailed in paragraph 5.

(b) Fit a new O-ring seal to the cover and locate the cover in the housing aperture.

(c) Assemble the extractor tool to the inner cover and adjust the tool so that the suction pads rest on the wing surface.

NOTE: When the cover plate is being pressed into position, the extractor tool must be held to the wing surface by its suction pads. Suction is exerted by raising the lever on the back of each pad.

(d) Press the cover into position, using the tool, and lock it in place by fully engaging the segments in the housing groove. Remove the extractor tool and secure the engaged segments with bolts and washers. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(5) Install the outer cover (Ref. Fig.402) as follows:

(a) If required, fit a new bonded seal to the outer cover as detailed in paragraph 5.

(b) To each of the 16 captive screws, fit a new sealing washer and O-ring seal. Ensure that the sealing washers and O-ring seals are not damaged when refitting the screws.

(c) Fit the cover in the aperture with the screws lightly tightened. Torque-tighten the screws in diametrically opposed sequence to 35 lbf in (0.395 mdaN).

(d) If required, fit new bonded seals to the centre cover, as detailed in paragraph 5., and secure the cover with four countersunk-head screws torque-tightened to 35 lbf in (0.395 mdaN).

(6) Check that the electrical bonding between components and attaching parts is in accordance with 20-27-11.

F. Conclusion

(1) Reset the engine feed pumps and the engine air start circuit breakers previously tripped.

(2) Remove the warning placards from the engine starting panel and the fuel management panel.

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(3) Leak-test the joints between the feed pipe and the accumulator by carrying out the Leakage Test for the engine feed and recirculation pipe and the engine feed pipe upstream of the accumulator (Ref. 28-21-00, Adjustment/Test).

(4) Carry out a Functional Test of the accumulator (Ref. Adjustment/Test).

R (5) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (6) Ensure that the mating faces of the tank access panel and structure are clean.

R (7) Refit the tank access panel (Ref. Fig.403) and torque-tighten the bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

R (8) Check that the electrical resistance between the panel and adjacent structure is in accordance with 20-27-11.

R (9) After refuelling, check the tank access panel for freedom from leakage.

3. Accumulator Diaphragm (Ref. Fig.407)

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel drain equipment, engine feed pipe	D925377000
Circuit breaker safety clips	-
Servicing stand, inner casing	E925071000
Air supply rig, to produce 10 psig (0.689 bar)	-

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B. Prepare to Remove Diaphragm

(1) Electrically isolate the engine feed pumps in the associated collector tank by tripping the appropriate circuit breakers (Ref. para.2.B.(3)). Fit safety clips.

(2) Ensure that the associated collector tank is less than 90 percent full.

(3) Drain the fuel from the associated engine feed pipe. (Ref. 28-21-00, Servicing).

(4) Empty the fuel from the accumulator bag (Ref. para.2.B.(6)).

(5) Check that there is no fuel flow from the accumulator drain (Ref. para.2.B.(7)).

C. Remove Diaphragm

(1) Remove the outer cover, the inner cover, and the inner casing (Ref. paras.2.C.(1), (2) and (3)).

(2) Reposition the locking segments on the inner casing.

(3) Invert the inner casing and place it on the servicing stand.

(4) Remove the diaphragm retainer and the diaphragm.

D. Install Diaphragm

(1) Place the inner casing on the servicing stand.

(2) Check that the diaphragm, and the surfaces of the inner casing and the retainer that grip the diaphragm bead, are clean and undamaged.

(3) Position the diaphragm so that it rests in the inner casing with the lettering COTE AIR (air side) visible, fit the diaphragm bead on the end of the casing ensuring that it is concentric on its seat.

CAUTION: AVOID ROTATING THE RETAINER AGAINST THE DIAPHRAGM, OR THE DIAPHRAGM BEAD MAY BE DAMAGED.

(4) Fit the diaphragm retainer on the inner casing so that their securing holes are aligned with the diaphragm bead clamped between them.

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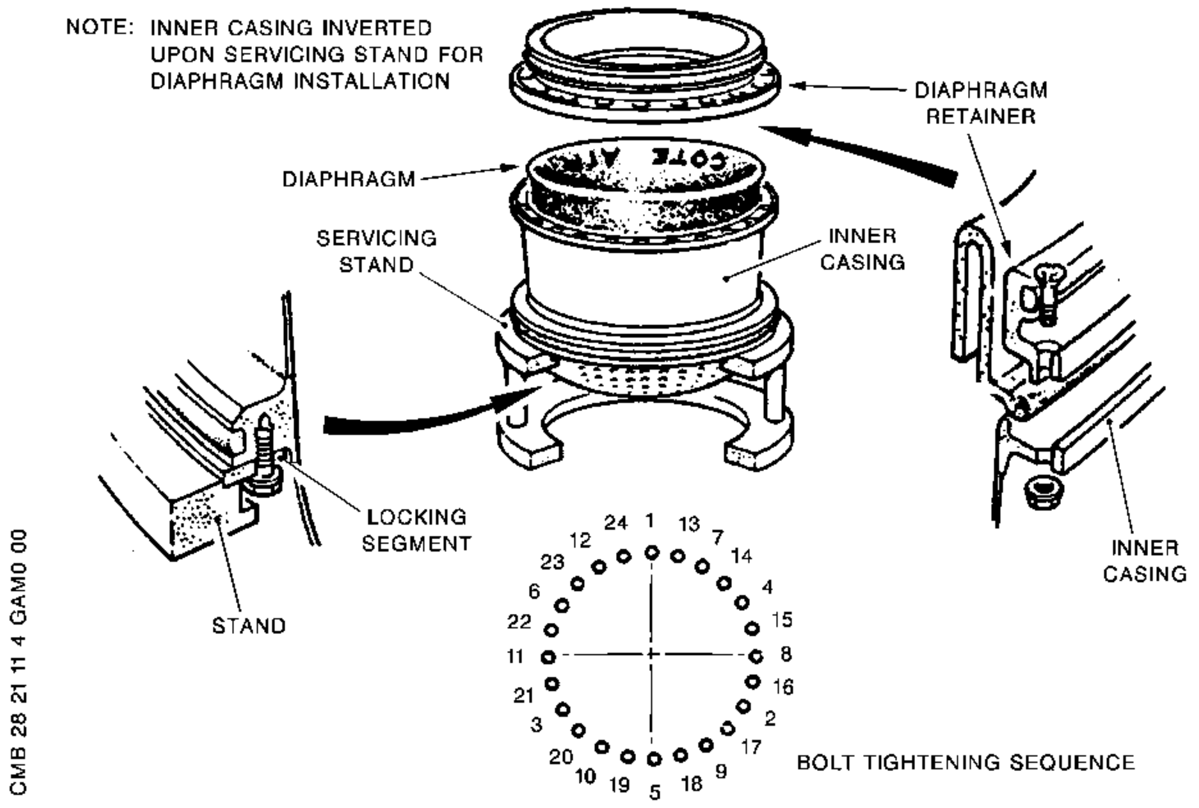

Accumulator Diaphragm - Installation
Figure 407

(5) Fit the screws into the stiffnuts. Tighten the screws progressively in the sequence shown (Ref. Fig.407). During this operation, continually check that the diaphragm is not being distorted near the bead, and that the adjacent flanges of the casing and retainer remain parallel. Finally, torque-tighten each screw to 40 lbf in (0.452 mdaN).

(6) Remove the inner casing from the stand and loosen the bolts securing the locking segments.

(7) Install the inner casing and the covers (Ref. paras.2.E.(3), (4) and (5).

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E. Conclusion

(1) Reset the engine feed pumps circuit breakers previously tripped.

(2) Carry out a Leakage Test of the accumulator (Ref. Adjustment/Test).

4. Non-return Valve (Ref. Fig.408)

A. Prepare to Remove Valve

(1) Trip the associated engine feed pumps circuit breakers (Ref. para.2.B.(3)). Fit safety clips.

(2) Remove the inner and outer covers (Ref. paras.2.C.(1) and (2)).

B. Remove Valve

(1) Unscrew the four captive bolts securing the valve and remove the valve.

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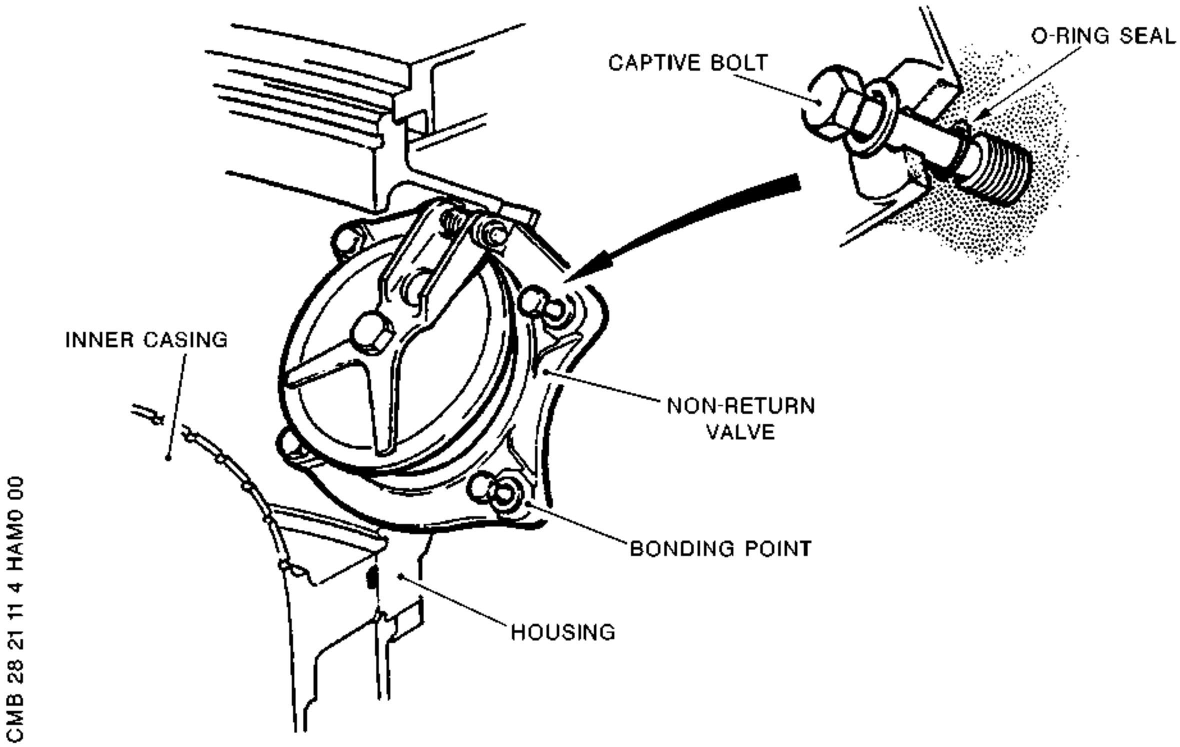

Non-return Valve - Installation
Figure 408

C. Install Valve

CAUTION: DO NOT OPEN THE VALVE MORE THAN 80 deg, TO AVOID STRAINING THE SPRING.

(1) Open the valve against its spring and check that the valve and its seat are clean and undamaged and that, when the valve is closed, the spring holds the valve against its seat.

(2) If the valve is being refitted, renew the O-ring seals on the captive bolts.

(3) Position the valve, spring uppermost, in the fuel inlet port of the housing and secure it with the captive bolts torque-tightened to 35 lbf in (0.395 mdaN).

NOTE: The lower right-hand bolt location is the electrical bonding point.

(4) Refit the inner and outer covers (Ref. paras.2.E.(4) and (5)).

D. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Carry out an Operational Test of the non-return valve (Ref. Adjustment/Test).

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5. Bonded Seal Renewal (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Adhesive, for bonded seals in accumulator covers	-
SCOTWELD, or equivalent substitute	SCOTCHWELD 1838BA
(Minnesota Mining and Manufacturing Co. Ltd., Penllergair, Gorseinon, South Glamorgan, Wales)	
Cleaning solvent for removing adhesive:	-
Methylethylketone (MEK) or equivalent substitute (Ref. 20-30-00, No.470)	
Lint-free cleaning tissues	-

B. Remove Seal

WARNING: MEK IS BOTH FLAMMABLE AND TOXIC.

(1) Apply a suitable cleaning solvent and remove the seal, using a suitably shaped tool made of wood or Tufnol.

NOTE: The solvent quoted will assist to remove the adhesive.

(2) Clean the seal grooves, applying the solvent with a clean, lint-free tissue, wrapped around the tool.

(3) Using clean tissues, remove all traces of solvent.

C. Install Seal

(1) Apply the adhesive quoted, or an equivalent substitute, in accordance with the manufacturer's instructions, and fit new seals. Clean off surplus adhesive.

(2) Ensure that the protrusion of the seals from the grooves is between 0.025 and 0.050 in (0.635 and 1.27 mm).

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ACCUMULATOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises a Functional Test of the accumulator diaphragm and an Operational Test of the accumulator non-return valve. A System Test is not applicable.

Control switches and indicators used for the tests are on the fuel management panel at the third crew member's station.

2. Functional Test - Accumulator Diaphragm

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, to supply an airflow of 10 scfm(*), minimum, at 80 psig (5.516 bar)	-
Minilock coupling at the air supply hose-end	SAREM 711AB
(*) - standard cubic feet per minute	

B. Prepare to Test Accumulator Diaphragm

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that the collector tank in which the accumulator is fitted contains at least 1,000 kg of fuel as shown on the appropriate fuel quantity indicator.

(4) Open the appropriate (No.1 or No.3) engine bay rear door to the servicing position (Ref. 71-00-00,

Servicing), to gain access to the fuel/hydraulic ground air charging (self-sealing) Minilock coupling (Ref. 28-21-00, Adjustment/Test).

(5) Remove the blanking cap from the coupling and connect the air supply rig.

(6) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(7) Check that the ACC caption is illuminated.

C. Test Accumulator Diaphragm

(1) Set the associated ENGINE FEED PUMPS switches to "ON"; check that the LOW PRESS captions are extinguished as pump pressure builds up.

(2) Check that the ACC caption remains illuminated.

(3) Operate the air supply rig and pressurize the accumulator air line to 80 psig (5.516 bar); check that the ACC caption is extinguished.

(4) Set the ENGINE FEED PUMPS switches to "OFF" and check that the ACC caption is illuminated.

(5) After a period of 30 s, during which the fuel is discharged from the accumulator, set the ENGINE FEED PUMPS switches to "ON" and check that the ACC caption is extinguished after 2 s.

(6) Run the pumps for a minimum period of 10 min and check that -

(a) there is no fuel leakage from the accumulator cover in the wing top surface, and

(b) with the air supply shut off and the accumulator drain plug removed (Ref. Removal/Installation), the drain is free of fuel.

NOTE: A continuous flow of fuel from the drain would indicate a damaged diaphragm.

(7) Set the ENGINE FEED PUMPS switches to "OFF".

D. Conclusion

(1) Refit the drain plug (Ref. Removal/Installation).

(2) Disconnect the air supply line and refit the blanking cap to the self-sealing coupling.

(3) Close the engine bay rear door (Ref. 71-00-00, Servicing).

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. <u>Operational Test - Non-return Valve</u>

A. Prepare to Test Non-return Valve

(1) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that the tank containing the accumulator to be tested contains at least 2,000 kg of fuel and the other collector tanks each have the capacity to receive 1,000 kg of fuel.

B. Test Non-return Valve

(1) Prove the fuel flow through the valve by pumping fuel from the associated collector tank to the other three collector tanks as follows:-

(a) Set the associated LP VALVE switch to "SHUT".

(b) Set all the CROSS-FEED valve switches to the open position (in line with the flow line on the panel).

<u>NOTE</u>: With this switch setting, when a standby pump is operated fuel will be pumped into the receiving tanks via their recirculation systems.

(c) Set either of the standby ENGINE FEED PUMPS switches in the associated collector tank to "ON".

(d) Run the pump for 3 min and check that the quantity of fuel transferred is not less than 33 kg/min through each recirculation system.

(e) Set the standby ENGINE FEED PUMPS switch to "OFF".

R R (2) Check that the valve will not allow reverse flow, as follows:-

R R (a) Ensure that the associated LP VALVE switch is at SHUT.

R (b) Set all the CROSS-FEED valve switches to the shut position (across the flow line on the panel).

(c) Set the associated collector tank jettison valve switch to "OPEN".

R R R (d) Set the INLET VALVE switch of an empty or partially filled tank to "OPEN"; (a LH switch for testing tanks 1 and 2 valves; a RH switch for testing tanks 3 and 4 valves).

(e) Set the associated collector tank main ENGINE FEED PUMPS switch to "ON" and check that there is no increase in the fuel content of the tank with the open inlet valve.

R (f) Set the ENGINE FEED PUMPS switch to "OFF".

R C. Conclusion

R (1) Set the INLET VALVE switch to "SHUT".

R R (2) Set the collector tank jettison valve switch to "SHUT".

R (3) Set the LP VALVE switch to "OPEN".

R R (4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

AIR CONTROL UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-41-00.

1. General

The air control unit for the accumulator in each engine feed line is located in the underwing fairing adjoining the associated collector tank.

2. Air Control Unit (Ref. Fig. 401)

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque-spanner, 645 to 655 lbf in (7.28 to 7.40 mdaN)	-
Torque spanner, 445 to 455 lbf in (5.03 to 5.14 mdaN)	-
Torque spanner, 305 to 315 lbf in (3.45 to 3.56 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.69 to 2.94 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.79 to 0.90 mdaN)	-

B. Prepare

(1) Electrically isolate the engine air starter motor by tripping the associated circuit breaker; fit a safety clip.

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R R	ENG 1 and 4 AIR START CONT	15-215	K181	C15

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 2 and 3 AIR START CONT	15-216	K182	D11

(2) Place a placard on the engine starting panel warning that the engine must not be run.

(3) Ensure that the fuel accumulator is not pressurized from a ground air supply rig.

(4) Remove the appropriate panel in the underwing fairing to gain access to the unit.

B. Remove

(1) Disconnect the engine air and vent pipes from the unit.

(2) Remove the four bolts and washers securing the T-junction to the unit.

(3) Remove the three bolts and washers securing the control unit to its support brackets; remove the unit.

(4) Disassemble the two unions from the control unit.

(5) Remove and discard the O-ring seals.

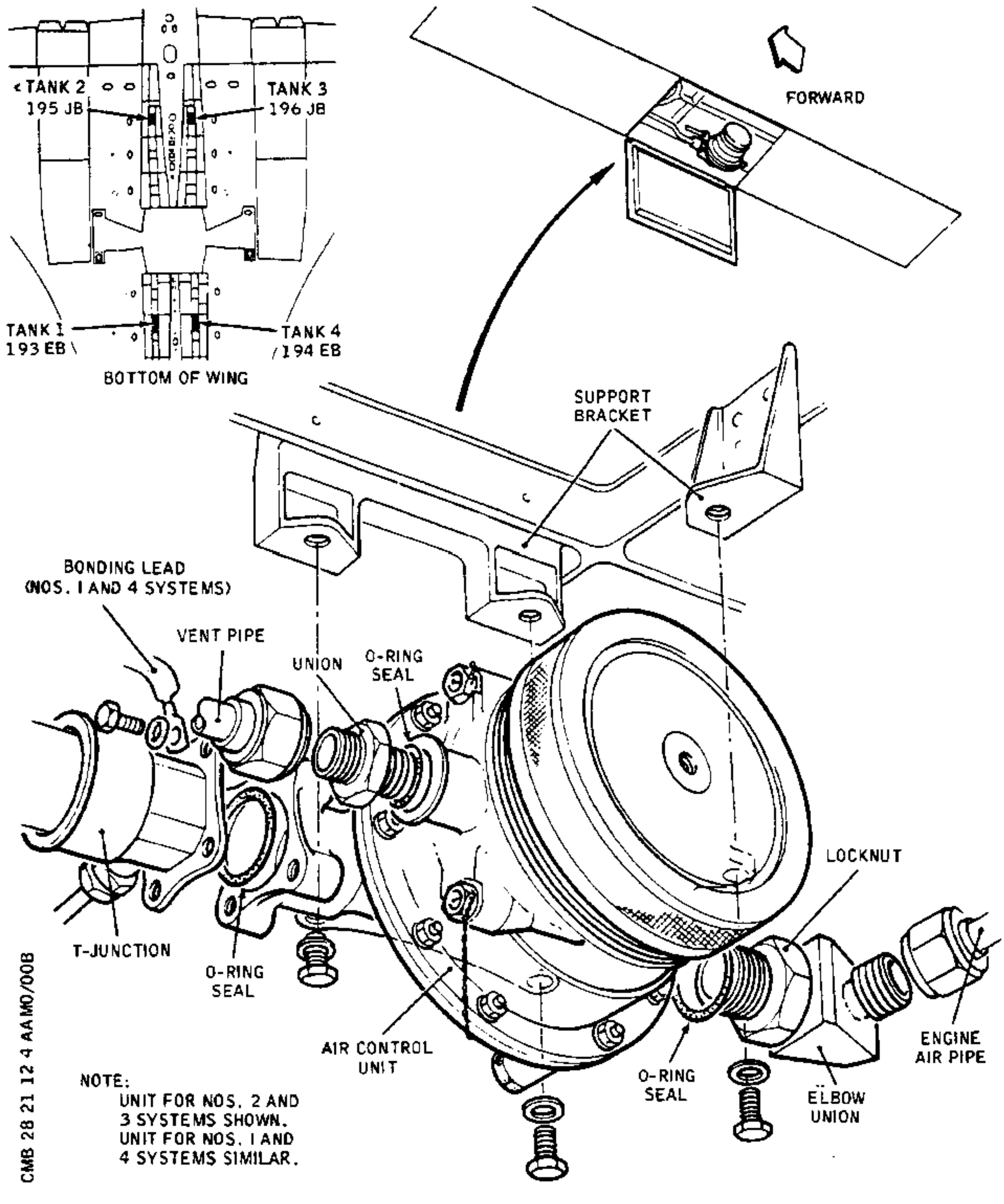
C. Install

(1) Comply with the fuel and electrical safety precautions.

R (2) Lubricate all O-ring seals in accordance with
R 20-23-11 prior to fitting.

R (3) Assemble the two unions to the control unit as follows:-

(a) System 2 or 3: Fit the elbow union for the
R engine air pipe, together with the locknut and a new O-ring seal. Do not tighten the locknut at this stage.



Air Control Unit - Installation
Figure 401

(b) System 1 or 4: Fit the straight union for the
R engine air pipe, together with a new O-ring seal; torque-tighten the union to between 645 and 655 lbf in (7.28 and 7.40 mdaN).

(c) Fit the union for the vent pipe, together with a new O-ring seal; torque-tighten the union to between 305 and 315 lbf in (3.45 and 3.56 mdaN).

R (4) Position a new O-ring seal on the T-junction.

R (5) Refit the control unit to its support brackets, ensuring that the bonding contact surfaces between them are clean, and secure the unit with three bolts and washers; torque-tighten each bolt to between 70 and 80 lbf in (0.79 and 0.90 mdaN).

R (6) Secure the T-junction to the control unit with the four bolts and lockwashers; torque-tighten each bolt to between 70 and 80 lbf in (0.79 and 0.90 mdaN).

<u>NOTE</u>: On systems 1 and 4 a bonding lead is secured beneath the head of one of the bolts. This bolt has a dimpled head.

R (7) On system 2 or 3, align the elbow union with the engine air pipe and secure it with the locknut; torque-tighten the locknut to between 645 and 655 lbf in (7.28 and 7.40 mdaN).

R (8) Connect the engine air pipe and the vent pipe to the
R unit; torque-tighten the engine air pipe coupling
R nut to between 445 and 455 lbf in (5.03 and 5.14 mdaN)
R and the vent pipe nut to between 150 and 250 lbf in
R (1.69 and 2.94 mdaN).

R (9) Check that the electrical bonding is in accordance
R with 20-27-11.

D. Conclusion

(1) Remove the safety clip and reset the circuit breaker tripped before removal.

(2) Carry out a Functional Test of the air control unit (Ref. 28-21-12, Adjustment/Test).

(3) Refit the access panel.

AIR CONTROL UNIT - ADJUSTMENT/TEST

1. General

This topic comprises a Functional Test, a Leakage Test and a Fuel Drainage Check. The Functional and Leakage Tests require a ground air supply to be connected to the Minilock coupling in the associated engine bay.

Operational and System Tests are not applicable.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing an airflow of 10 scfm* at 130 psig (8.963 bar) pressure	-
Minilock coupling at the air supply hose-end	SAREM 711 AB
Pressure gauge, 0 to 40 psi (0 to 2.758 bar)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-

* Standard cubic feet per minute

B. Prepare to Test

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(2) Open the appropriate (No.1 or No.3) engine bay rear door to the servicing position (Ref. 71-00-00, Servicing), to gain access to the fuel/hydraulic ground air charging Minilock coupling (Ref. Fig. 501).

NOTE: Air pressure applied at the coupling in No.1 engine bay will pressurize tanks 1 and 2

accumulators via their associated air control units; similarly, pressure applied at the coupling in No.3 engine bay will pressurize tanks 3 and 4 accumulators. Pressure applied at either coupling will pressurize the hydraulic reservoirs.

(3) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(4) Remove the cap from the coupling and connect an air supply rig.

(5) Remove the access panels in the wing fillet below the appropriate collector tank (Ref. Fig. 502) to gain access to the air control unit and the associated accumulator drain.

(6) Disconnect the pressure switch pipe at the outlet of the air control unit (Ref. Fig. 502) and install a 0 to 40 psi (0 to 2.758 bar) pressure gauge at the pipe tapping.

C. Test

(1) Switch on the air supply and increase the pressure at the connection to the aircraft systems to 130 psig (8.963 bar).

(2) Check that the pressure gauge at the air control unit outlet indicates between 13.5 and 15.5 psig (0.931 and 1.069 bar).

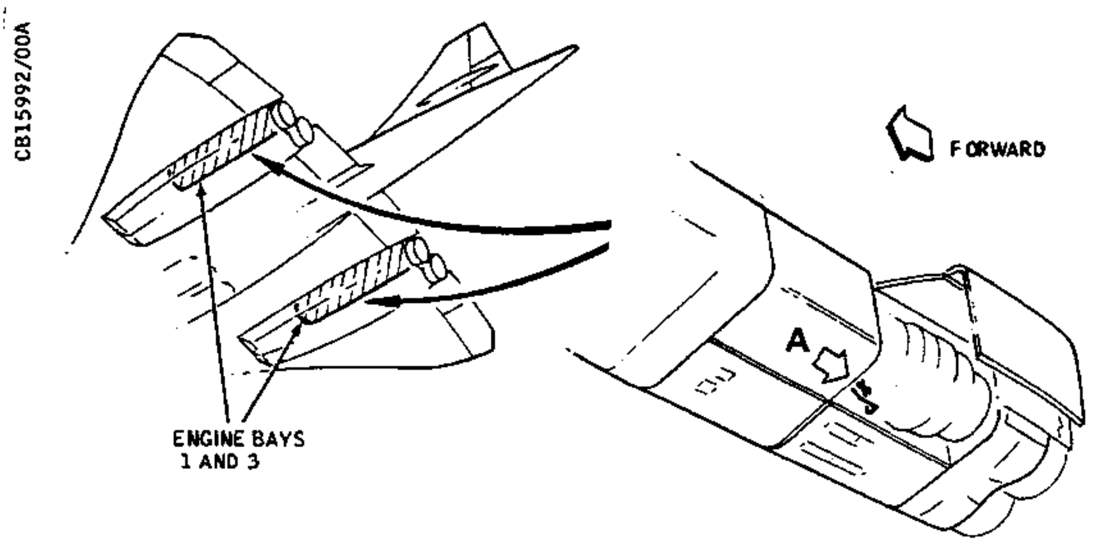
(3) Switch off the air supply and exhaust the air from the system.

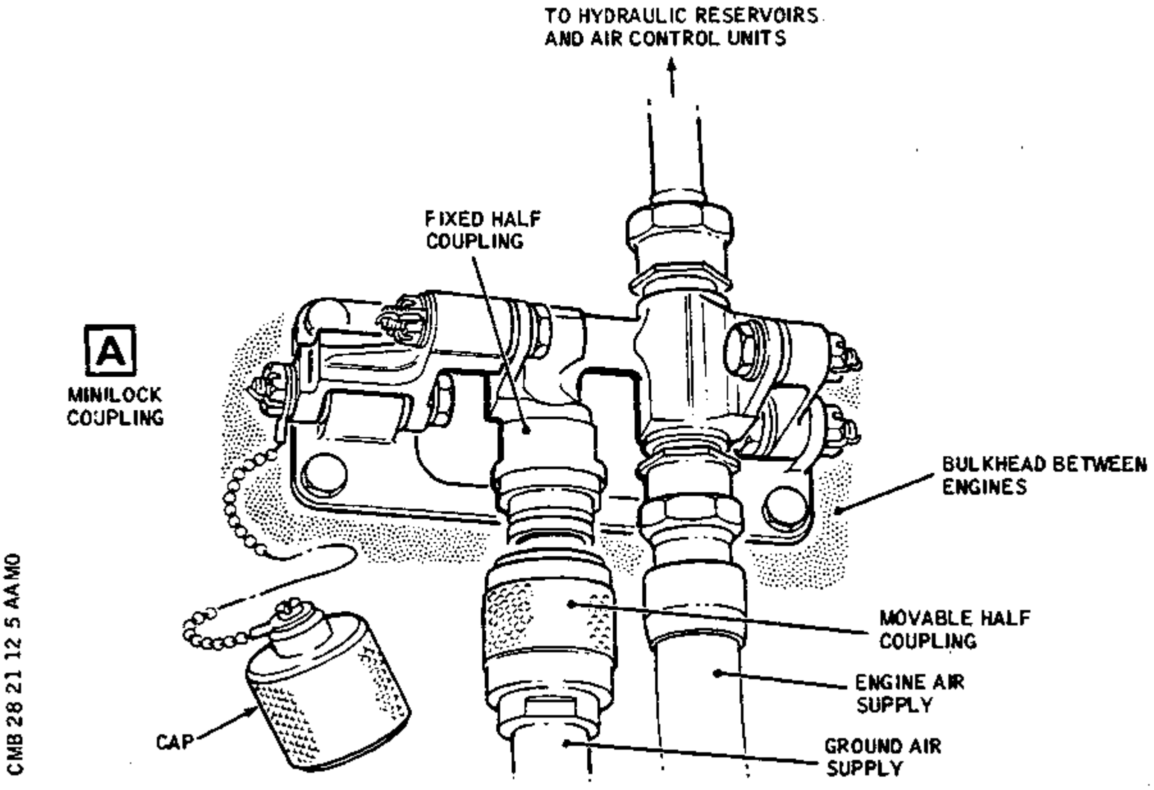
(4) Remove the plug from the accumulator drain associated with the air control unit under test (Ref. Fig. 502); remove and discard the O-ring seal from the plug.

(5) Switch on the air supply and increase the pressure at the connection to the aircraft systems to 130 psig (8.963 bar).

(6) Check that the pressure gauge at the air control unit outlet reads at least 6.0 psig (0.414 bar).

(7) Switch off the air supply and exhaust the air from the system.

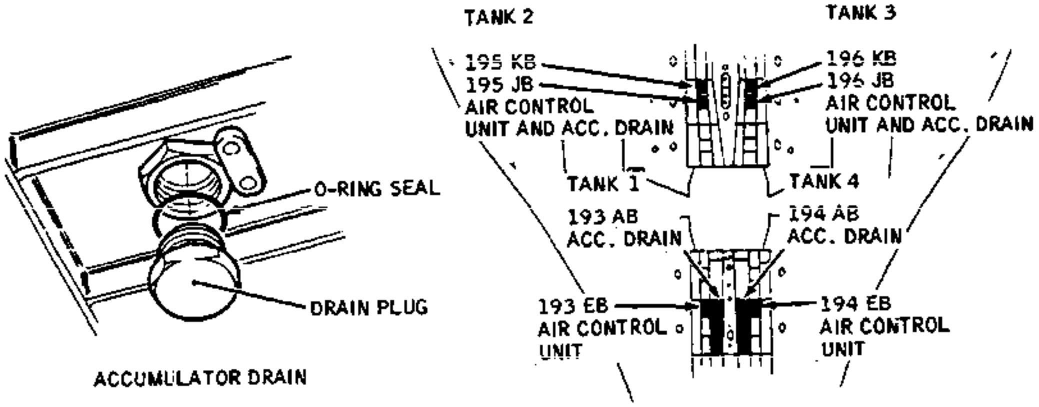


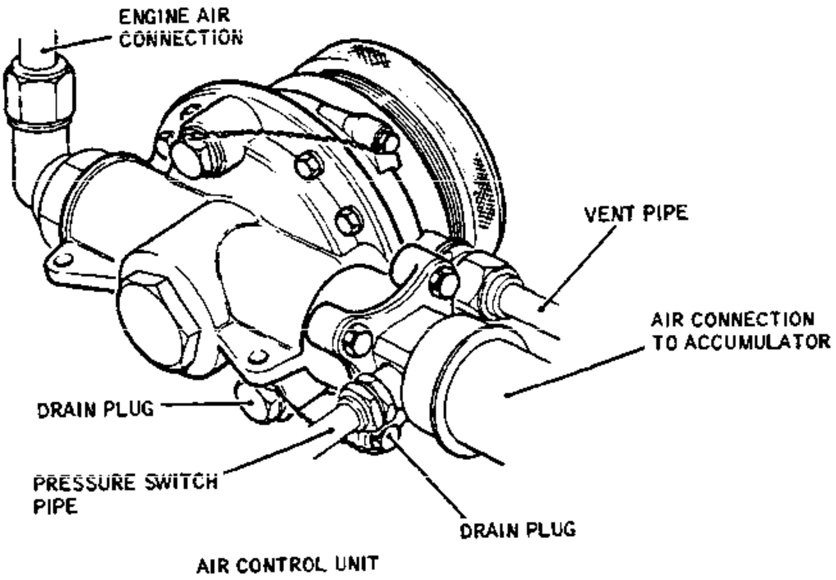


Fuel/Hydraulic Ground Air Charging
Minilock Coupling
Figure 501

R

CB15993/00A





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\- Air Control Unit and Accumulator
Drain - Locations
Figure 502

R

D. Conclusion

(1) Remove the pressure gauge from the air control unit outlet and reconnect the pressure switch pipe. Torque-tighten the pipe union nut to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the accumulator drain plug.

(3) Refit the accumulator drain plug.

(4) Carry out a Leakage Test of the pressure switch pipe connection (Ref. para.3.).

3. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of producing an airflow of 10 scfm* at 80 psig (5.516 bar)	-
Minilock coupling at the air supply hose-end	SAREM 711 AB
Soap solution -	-
Approved types:	
SNOOP	
R (Ref. 20-30-00, No.195)	
SHERLOCK	
R (Ref. 20-30-00, No.196)	

* Standard cubic feet per minute

B. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Check that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the setttings of the switches must not be altered.

(3) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(4) Connect an air supply rig to the appropriate Minilock coupling in the engine bay as detailed in paragraph 2.B.

(5) Remove the access panel(s) (Ref. Fig. 502) to gain access to the air control unit.

C. Test

(1) Switch on the air supply and increase the pressure at the connection to the aircraft systems to 80 psig (5.516 bar).

(2) On the fuel management panel, check that the accumulator ACC caption is illuminated.

(3) Check, using an approved soap solution, that there is no air leakage at any of the pipe connections to the air control unit.

(4) Switch off the air supply and exhaust the air from the system; check that the ACC caption on the fuel management panel is extinguished.

D. Conclusion

(1) Disconnect the air supply pipe in the engine bay and refit the cap to the Minilock coupling (Ref. Fig. 501).

(2) Close the engine bay door (Ref. 71-00-00, Servicing).

(3) Refit the access panel(s).

(4) Remove the warning placard from the fuel management panel.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Fuel Drainage Check

(1) Open the access panel(s) to gain access to the air control unit.

(2) Remove the lower drain plugs from the air control unit and allow any fuel that may be present in the unit to drain.

NOTE: Fuel may get into the unit through flooding of the vent system piping.

(3) Remove and discard the O-ring seals from the drain plugs.

(4) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the drain plugs; refit the drain plugs and wire-lock them in accordance with 20-21-13.

PUMP UNITS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

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1. General

Three engine feed pump units, one main, one 1st standby, and one 2nd standby are located in each of tanks 1, 2, 3 and 4. Each unit, secured to the floor of the tank, comprises a pump element fitted into an isolation canister, which permits the element to be removed without draining fuel from the tank. If the canister is to be removed, the tank must be drained. This topic comprises removal/installation procedures applicable to the pump element, the isolation canister and the canister flap relief and outlet non-return valves.

2. Pump Element (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 95 to 105 lbf in (1.073 to 1.186 mdaN).	-
Electrical bonding tester	-
Container, 1.75 pints (1 l), for drained fuel	-

B. Prepare to remove Pump Element

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(2) Electrically isolate the pump to be removed, by tripping the associated circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1, MAIN PUMP SUP	1-213	1Q 834	J 3
TANK 1, MAIN PUMP IND	15-216	1Q 831	B 1
TANK 1, ST'BY 1 PUMP SUP	4-213	1Q 835	F 5
TANK 1, ST'BY 1 PUMP IND	15-216	1Q 832	B 2
TANK 1, ST'BY 2 PUMP SUP	13-216	1Q 836	D 1
TANK 1, ST'BY 2 PUMP IND	15-216	1Q 833	B 3
TANK 2, MAIN PUMP SUP	1-213	2Q 834	L 3
TANK 2, MAIN PUMP IND	15-215	2Q 831	B19
TANK 2, ST'BY 1 PUMP SUP	4-213	2Q 835	B 5
TANK 2, ST'BY 1 PUMP IND	15-215	2Q 832	B20
TANK 2, ST'BY 2 PUMP SUP	14-216	2Q 836	F 4
TANK 2, ST'BY 2 PUMP IND	15-215	2Q 833	B21
TANK 3, MAIN PUMP SUP	1-213	3Q 834	N 3
TANK 3, MAIN PUMP IND	15-216	3Q 831	B 4

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	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
	TANK 3, ST'BY 1 PUMP SUP	4-213	3Q835	A8
	TANK 3, ST'BY 1 PUMP IND	15-216	3Q832	B5
	TANK 3, ST'BY 2 PUMP SUP	14-215	3Q836	G14
	TANK 3, ST'BY 2 PUMP IND	15-216	3Q833	B6
	TANK 4, MAIN PUMP SUP	1-213	4Q834	Q3
R	TANK 4, MAIN PUMP IND	15-215	4Q831	B22
	TANK 4, ST'BY 1 PUMP SUP	4-213	4Q835	F8
R	TANK 4, ST'BY 1 PUMP IND	15-215	4Q832	B23
	TANK 4, ST'BY 2 PUMP SUP	13-215	4Q836	G16
R	TANK 4, ST'BY 2 PUMP IND	15-215	4Q833	B24

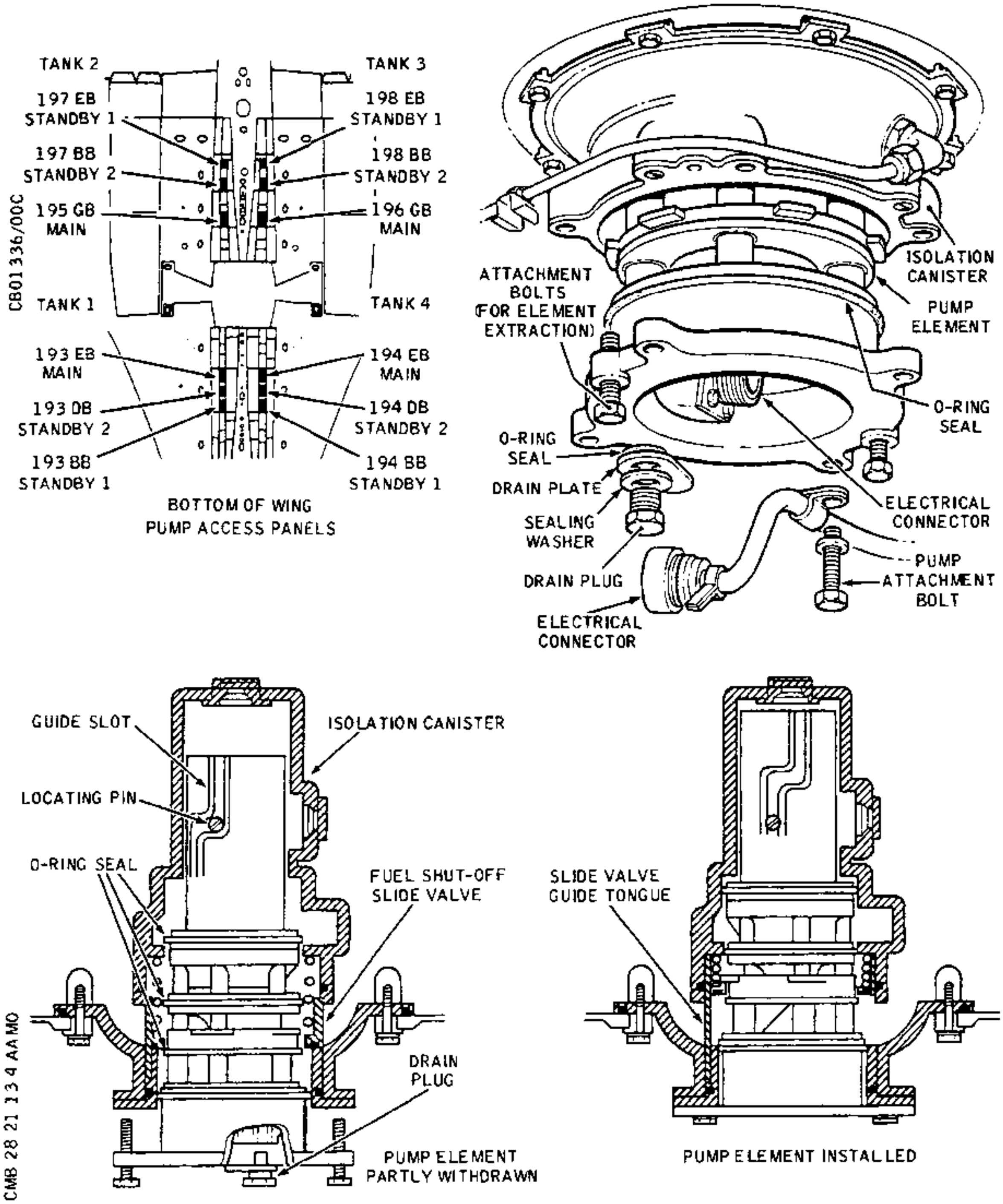
R (3) Gain access to the pump by removing the appropriate
R access panel in the wing lower fairing
R (Ref. Fig. 401).

(4) Place a suitable container in position to collect any fuel that may drain from the pump during removal.

R C. Remove Pump Element

(1) Disconnect the electrical connector from the pump unit.

(2) Unlock and slacken the drain plug just sufficiently



R - Pump Element - Installation (Typical)
Figure 401

to facilitate its removal.

(3) Remove the four bolts and washers securing the pump element to the canister. Note the position of the special earthing bolt during removal. Fit two of the bolts into the extractor holes in the element flange and screw them in evenly to withdraw the pump as far as the guide slots will permit.

NOTE: When the pump element has been withdrawn approximately 1.0 in (25.4 mm), the slide valve should seat, closing the fuel ports to the tank. Excessive steady leakage indicates that the valve is not seated correctly.

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(4) Slacken the drain plug sufficiently to permit the drain plate to be swung clear of the drain hole. Move the plate and allow fuel to drain from the element. Remove the plug and plate, discard the sealing washer and O-ring seal.

NOTE: Approximately 1.5 pints (0.85 l) of fuel will drain from the pump.

(5) Turn the element counter-clockwise until checked by the guide slot, and withdraw it from the isolation canister. Remove the bolts from the extractor holes and the three O-ring seals from the pump element body.

B (6) NRV Leak Check - Pump Removed (To be performed at each pump
B removal).

B WARNING: DURING THIS CHECK THE ENGINE FEED PUMP SUPPLY CBs
B MUST REMAINED TRIPPED.

B NOTE: In the case of TANK 4 it is permissible to reinstate
B the INDICATION CB panel 15-215 in order to power the
B collector tank jettison valve

B (a) OPEN associated collector tank jettison valve.

B (b) Station observer near pump isolation chamber.

B (c) Switch ON TANK 9 pump (same side of aircraft) for a few
B seconds then switch off (to limit fuel spillage in
B event of NRV jammed open).

B (d) Observe no significant increase in leak rate from
B isolation chamber. If necessary switch pump ON and
B check leakage does not exceed 150 cc/min.

B B B (7) Temporarily refit the drain plate and drain plug and fit suitable blanks to the ports of the isolation canister and pump element.

D. Prepare to install pump element

(1) Observe the fuel and electrical safety precautions.

(2) Lubricate all seals in accordance with 20-23-11.

(3) Remove the blanks from the isolation canister and pump element.

(4) Fit three new O-ring seals to the element body and a new O-ring seal to the drain plate. Secure the drain plate with a new seal washer and the drain plug. Torque-tighten the plug to between 95 and 105 lbf in (1.073 and 1.186 mdaN).

(5) Check that the fuel leakage from the canister valves does not exceed 83 cc/min. If excessive leakage occurs, renew the sealing ring or gasket on the faulty valve (Ref. paras.4. and 5.).

E. Install pump element

<u>WARNING</u>: THE CANISTER SLIDE VALVE MUST NOT BE OPERATED WHEN DRY. SPRAY FUEL BETWEEN THE CANISTER AND SLIDE VALVE BEFORE INSTALLING THE PUMP ELEMENT.

BEFORE INSTALLING THE PUMP ELEMENT ENSURE THAT THE CANISTER SLIDE VALVE IS FULLY DOWN.

DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

(1) Insert the pump element into the isolation canister so that the canister locating pin engages in the element guide slot. Slide the element in until it is stopped by the slot approximately 1.0 in (25.4 mm) from the fully installed position.

<u>CAUTION</u>: OPERATION (2) LIFTS THE CANISTER SLIDE VALVE TO OPEN THE FUEL PORTS. DO NOT FORCE THE ELEMENT OR DAMAGE TO THE SLIDE VALVE MAY RESULT.

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(2) Turn the element clockwise to align the attachment holes, push it in fully, using hand pressure only. Retain it in this position and fit the four attachment bolts and washers, locating the electrical clip on the appropriate bolt.

(3) Progressively screw in the bolts evenly in a diametrically opposite sequence until tight. Finally torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(4) Using a bonding tester, check that the electrical resistance between the pump element and the isolation canister is not greater than 0.025 ohm.

(5) Connect the electrical connector to the pump, ensuring that the mating surfaces are clean and undamaged.

(6) Remove the safety clips and reset the circuit breakers tripped in operation B.(2).

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F. Conclusion

(1) Carry out an Operational Test of the pump element (Ref. 28-21-13, Adjustment/Test).

(2) Refit the access panel.

3. Isolation Canister (Ref. Fig.402 and 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	
Electrical bonding tester	-

DESCRIPTION	PART NO.
Container, 10 gal (Imp.) (45.5 l), for drained fuel	-
After SB 28-018 For A/C 001-005,	
Sealant tools for removal/application of sealants (Ref. 28-11-00, Approved Repairs - Sealants)	-
Sealants etc.	-
PR1720R (Ref. 20-30-00, No.390)	-
PR1720SM (Ref. 20-30-00, No.351)	-
PR1720F (Ref. 20-30-00, No.352)	-
Cyclohexanone, for use with sealant PR1720R	-
Cleaning solvents	-
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
Halogenated hydrocarbon solvent R.113 (Ref. 20-30-00, No.484)	-
RB Eurotwill cloth	-

B. Prepare to Remove Canister

(1) Drain the tank, from which the canister is to be removed, in accordance with the instructions given

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in 28-25-00, Servicing.

(2) Remove the pump element (Ref. para.2.).

(3) Drain the residual fuel from the fuel feed line by removing the outlet non-return valve in the canister (Ref. para.5.) and draining the fuel into a clean container.

(4) Open the appropriate tank access panel (Ref. Fig. 402) in the wing lower surface to gain access to the canister from within the tank.

C. Remove Canister

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Disconnect the pressure switch pipe from the restrictor union, the pressure switch and the pipe bracket (if applicable); remove the pipe.

(2) Disconnect the electrical bonding lead from the wire-mesh filter.

(3) Remove the upper section of the wire-mesh filter to permit disconnection of the fuel feed pipe.

(4) Disconnect the feed pipe from the canister and slacken, as necessary, the adjoining pipe connectors to obtain sufficient clearance to remove the canister.

Before SB 28-018

(5) Remove the canister attachment bolts and washers, together with the clamping ring and anti-rotation plate; remove the canister. Note the positions of the special earthing bolts during removal.

After SB 28-018 For A/C 001-005,

WARNING: SOLVENTS 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC; R.113 IS TOXIC.

TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS WHEN USING CLEANING SOLVENTS.

(5) Remove the canister as follows:-

(a) Remove the canister attachment bolts and washers, together with the clamping ring and anti-rotation plate. Note the positions of the special earthing bolts during removal.

(b) Using the sealant cutting tool and solvents, carefully separate the canister from the tank.

(c) Remove the canister from the tank.

(d) Thoroughly clean off any remaining sealants.

(6) Fit suitable blanks to the canister ports and tank apertures.

D. Prepare to Install Canister

(1) Observe the fuel and electrical safety precautions.

(2) Lubricate all O-ring seals in accordance with 20-23-11.

(3) Remove the blanks fitted to the canister ports and tank apertures.

(4) Ensure that the tank aperture surround, the joint flange of the canister and the anti-rotation plate are perfectly clean and free from corrosion.

(5) If a new canister is to be fitted, proceed as follows:-

(a) Remove the pressure switch pipe restrictor union from the old canister and fit it loosely, together with a new O-ring seal, to the new canister.

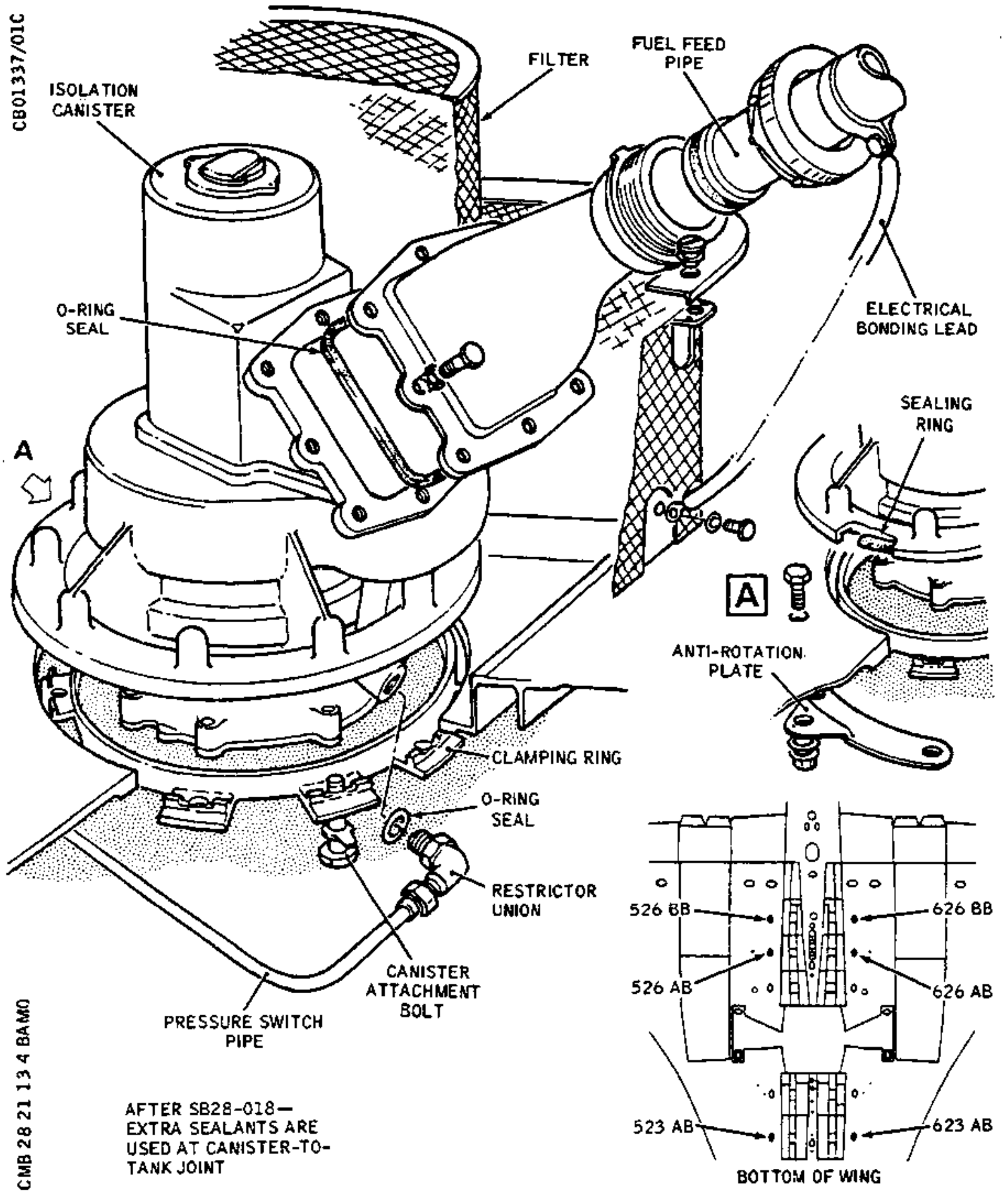
E. Install Canister

<u>CAUTION</u>: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

(1) Observe the fuel and electrical safety precautions.

Before SB 28-018

(2) Fit a new sealing ring in the annular groove on the canister attachment flange.



\- Isolation Canister - Installation (Typical)
Figure 402

After SB 28-018 For A/C 001-005,

(2) Apply sealant as follows:-

(a) Fit a new, dry O-ring seal to the groove on the canister attachment flange.

(b) Apply sealant PR1720R (prefabricated tape) or PR1720SM (semi-paste/fluid) to the O-ring seal portion of the mounting flange in accordance with 20-22-12.

(3) Position the canister on the tank mounting flange and loosely fit the clamping ring and the anti-rotation plate with the canister attachment bolts and new lockwashers.

(4) Fit a new O-ring seal to the fuel feed pipe attachment flange and secure the pipe to the canister. Torque-tighten each bolt to between 28 and 32 lbf in (0.316 and 0.362 mdaN), and secure it with the tabwasher.

NOTE: In tanks 1 and 4, the centre (1st standby) pump has a bracket secured by the feed pipe attachment bolts to support the top of the filter.

(5) Secure the anti-rotation plate to the tank, using the bolt, nut and washer. Torque-tighten the nut to between 62 and 71 lbf in (0.700 and 0.802 mdaN).

Before SB 28-018

(6) Ensure that the canister is positioned concentrically on the tank mounting flange and tighten the canister attachment bolts evenly and progressively in a diametrically opposite sequence. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

After SB 28-018 For A/C 001-005,

(6) Secure the canister as follows:-

(a) Ensure that the canister is positioned concentrically on the tank mounting flange.

(b) Torque-tighten the canister attachment bolts, evenly and progressively in a diametrically opposite sequence, to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(c) Using sealant PR1720F (thick thixotropic paste), in accordance with 20-22-12, encapsulate the head of the securing bolt for the anti-rotation plate. Allow the sealant to become tack-free, then apply an over-coating of sealant PT1720SM.

(7) Refit the upper section of the wire-mesh filter, securing the electrical bonding lead from the fuel feed pipe, using the filter attachment bolt with the dimpled head. Check that the bonding is in accordance with 20-27-11.

(8) Fit the pressure switch pipe to the pressure switch and to the pipe bracket (if applicable). Torque-tighten the pipe union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(9) Fit and align the restrictor union on the canister with the pressure switch pipe as detailed in 28-22-12, Fig. 403, 'Sensing Pipe - Adapter Installation'. Torque-tighten the restrictor union nut to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(10) Fit the pressure switch pipe to the restrictor union. Torque-tighten the pipe union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

F. Conclusion

(1) Carry out a Leakage Test of the canister pipe and tank joints and canister valves (Ref. Adjustment/Test).

(2) Refit the pump element (Ref. para.2.).

R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Refit tank access panel.

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4. Flap Relief Valve (Ref. Fig. 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
AF hexagonal key, 9/64 in (3.5 mm)	-
Right-angled torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	Plessey 558-4-03288
Torque screwdriver, 3 to 5 lbf in (0.034 to 0.056 mdaN)	-
Torque screwdriver, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-

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B. Prepare to Remove Relief Valve

(1) Defuel the appropriate tank (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. para.2.).

C. Remove Relief Valve

(1) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers securing the flap valve mounting adapter to the canister and withdraw the mounting adapter, complete with flap valve.

(2) Remove the screws and washers securing the flap valve to the mounting and remove the valve. Remove and discard the sealing ring.

D. Install Relief Valve

CAUTION: WHEN A SIDE-MOUNTED VALVE IS REFITTED (DETAIL B), ENSURE THAT THE VALVE IS POSITIONED WITH THE HINGE UPPERMOST.

TIGHTEN ALL THE SCREWS EVENLY. UNEVEN TIGHTENING CAN DISTORT THE VALVE MOUNTING PLATE AND CAUSE MALFUNCTIONING.

(1) Fit a new flap valve to the mounting adapter. Torque-tighten the securing screws to between 3 and 5 lbf in (0.034 and 0.056 mdaN).

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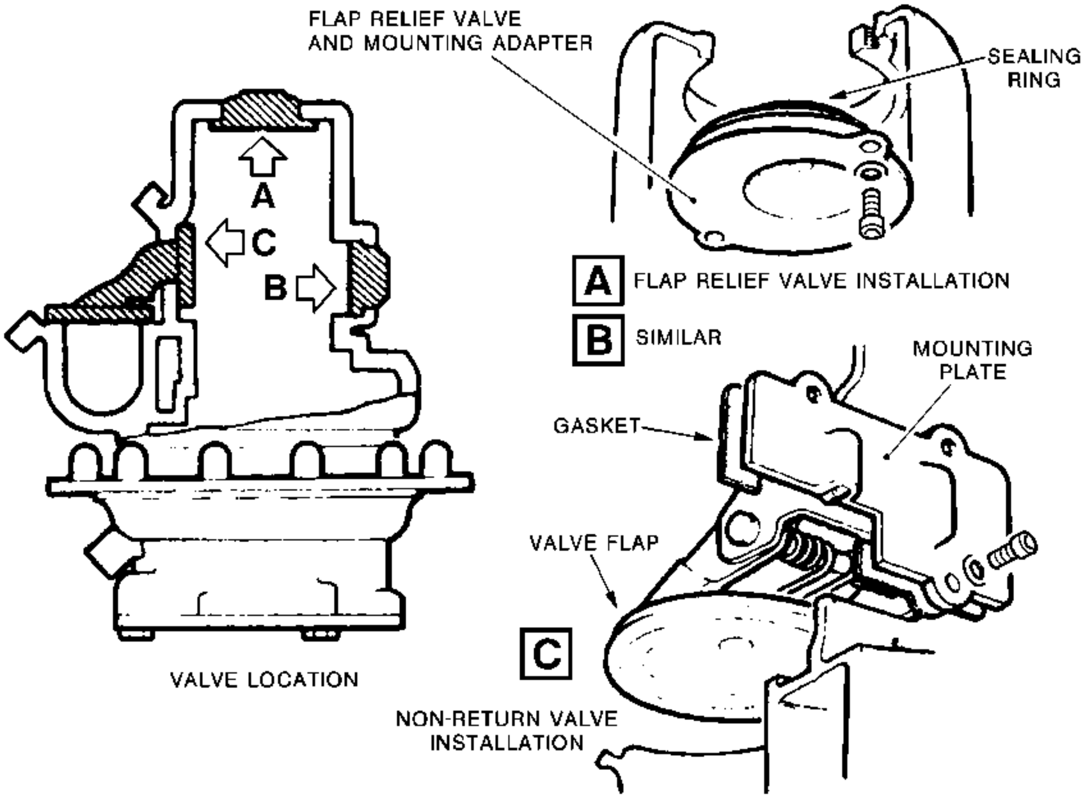

Flap Relief and Outlet Non-return Valves - Installation
Figure 403

(2) Fit a new, dry, sealing ring in the groove around the mounting adapter, then lubricate the exposed surface in accordance with 20-23-11.

(3) Check that the flap valve opens, and then returns and seats correctly when released.

(4) Locate the valve assembly in its bore from within the canister, aligning the attachment holes. Fit the securing washers and screws. Torque-tighten the screws to between 9 and 11 lbf in (0.102 and 0.124 mdaN), using the right-angled torque spanner if the valve is located in the side wall, or the torque screwdriver, with a hexagonal key insert, if the valve is in the canister crown.

(5) Refuel the tank (Ref. 12-11-28).

(6) Check the flap valve for leakage of fuel. The total leakage from all the canister valves must not exceed 83 cc/min.

E. Conclusion

(1) Install the pump element (Ref. para.2.).

5. Non-return Valve (Ref. Fig. 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Right-angled torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	Plessey 558-4-03288
AF hexagonal key, 9/64 in (3.5 mm)	-
Locking compound, Loctite Grade A, (Ref. 20-30-00, No.109)	-
Sealant, PR 1005L (Ref. 20-30-00, No.372)	-
Methylethylketone, for removing sealant (Ref. 20-30-00, No.470)	-
Container, 10 gal (Imp.) (45.4 l), for drained fuel	-

B. Prepare to Remove Non-return Valve

(1) Remove the pump element (Ref. para.2.).

C. Remove Non-return Valve

(1) Position a clean container to collect residual fuel that will drain from the fuel feed pipe during the next operation.

(2) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers and carefully withdraw the non-return valve assembly, complete with gasket, from the outlet bore.

NOTE: When removing the screws, the pressure applied by the spring will cause the valve mounting to tilt toward the centre of the canister bore.

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D. Install Non-return Valve

WARNING: METHYLETHYLKETONE IS BOTH HIGHLY FLAMMABLE AND TOXIC. IT IS ESSENTIAL THAT THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS ARE TAKEN WHEN USING THIS SOLVENT.

(1) Using methylethylketone, remove the old gasket and clean and degrease the face of the non-return valve mounting plate.

(2) Lightly coat the gasket mating face, of the mounting plate only, with sealant PR 1005L, ensuring that the sealant is kept clear of the securing holes. Allow the sealant to dry until it is firm to touch (approximately 15 min).

NOTE: Operations (3) to (6) must be effected within 20 min of applying the sealant.

(3) Fit the gasket to the mounting plate, ensuring that the holes are correctly aligned.

(4) Ensure that the gasket mating face of the canister is clean and then position the valve assembly in the canister with the valve-flap spring uppermost. Guide the valve flap into the outlet duct and ensure that the spigot of the mounting plate has entered the duct.

(5) Secure the valve assembly to the canister wall with the washers and screws, after applying the minimum effective amount of Loctite Grade A to the screw threads.

NOTE: As the fitting of the valve assembly to the canister is a one-handed operation, it is recommended that the top two screws be engaged first to counteract the tendency of the spring to tilt the mounting.

(6) Evenly tighten the screws, removing any exuded Loctite. Using the right-angled torque spanner, torque-tighten the screws to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

E. Conclusion

(1) Carry out a Leakage Test of the non-return valve (Ref. Adjustment/Test).

(2) Install the pump element.

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(2) Install the pump element (Ref. para.2.).

PUMP UNITS - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Three engine feed pump units - one main and two standby - are fitted to the floor in each of the four collector tanks, and are accessible through access panels in the underwing fairing. Each unit comprises a pump element fitted within an isolation canister which permits the element to be removed without the necessity for draining the fuel from the tank. In order to test a canister, the tank must be drained and the pump element removed.

R Controls and indicators are at the third crew member's position.

The following procedures comprise an Operational Test of the
R pump element, and a Leakage Test of the pump canister and
R engine feed pipe. Functional and Leakage Tests applicable
R to the pump non-return valve are also detailed under separate
R headings. A System Test is not applicable.

2. Operational Test - Pump Element (Ref. Fig. 501)

A. Prepare

(1) Check that the collector tank in which the pump is fitted contains sufficient fuel for the test. Refuel as necessary (Ref. 12-11-28).

(2) Make available electrical ground power as detailed in 24-41-00.

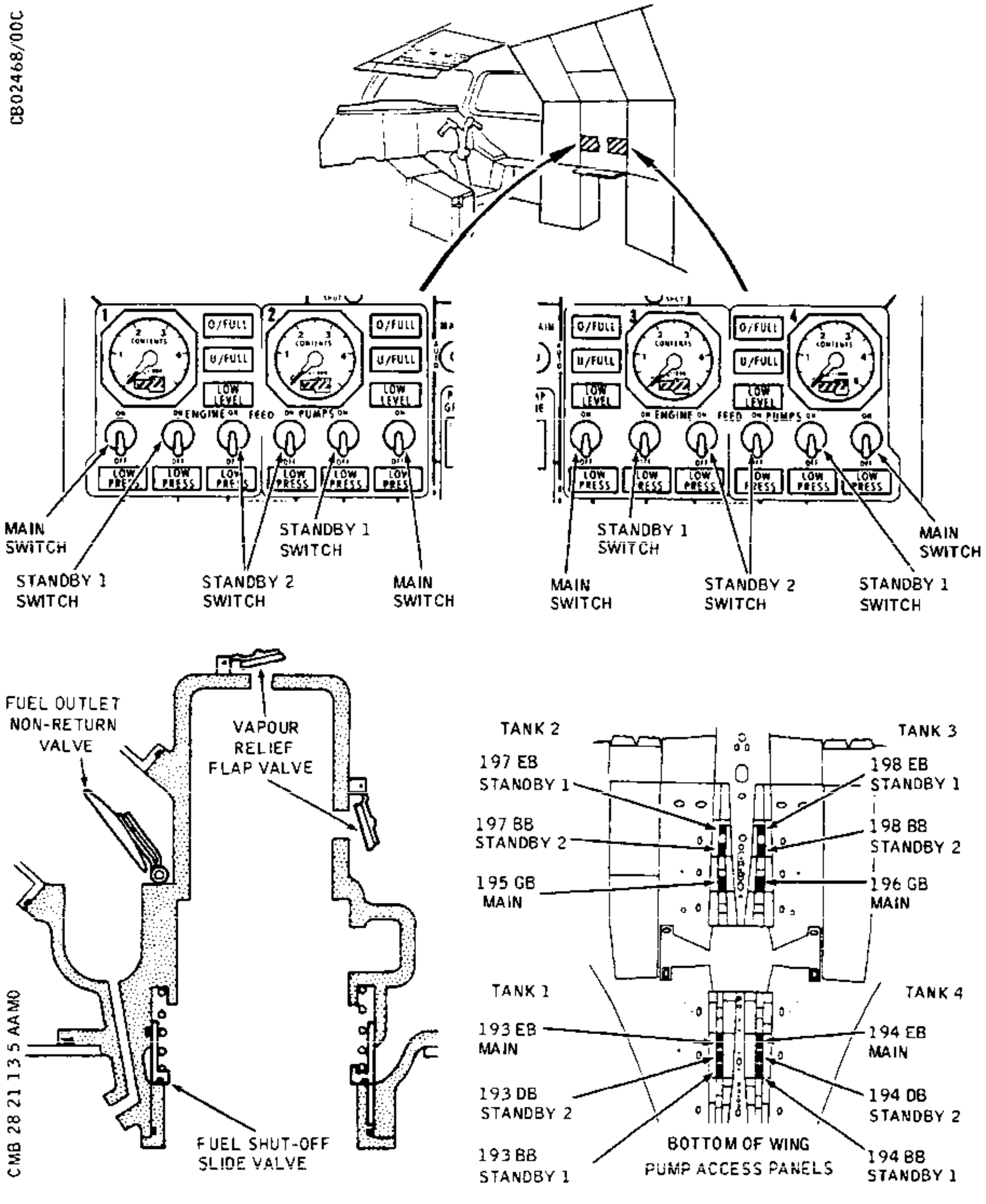
(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Check that all ENGINE FEED PUMPS LOW PRESS captions are illuminated.

R (5) Remove the appropriate access panel (Ref. Fig. 501).

B. Test

(1) Check a main pump element for fuel flow, as



R - Canister Valves and Pump/Switch Locations
Figure 501

follows:

(a) Set the CROSS-FEED valve switch for the engine feed system containing the pump under test to open (in-line).

(b) Select any one of the three other collector tanks with room to receive the fuel to be passed during the flow check and set its associated CROSS-FEED valve switch to open (in-line).

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R (c) Close the LP isolation valve associated with the
R pump under test by setting the appropriate LP
R VALVE switch to "SHUT 1".

NOTE: With this switch setting, when a main pump is operated, fuel will be transferred to the chosen tank via the cross-feed and
R recirculation pipelines provided the LP
R isolation valve associated with the
R collector tank being fed is in the normal
R OPEN position.

(d) Set the appropriate ENGINE FEED PUMP switch to "ON". Check that the associated LOW PRESS caption is extinguished after 3 s as pump pressure builds up.

(e) Check that the quantity of fuel transferred is
R between 100 and 125 kgs after 3 minutes.

(f) At the conclusion of the test:

f1) Set the ENGINE FEED PUMPS switch to "OFF" and check that the associated LOW PRESS caption is illuminated after 3 s as pump pressure falls off.

f2) Set the CROSS-FEED valves switches to shut (cross-line).

f3) Set the LP VALVE switch to "OPEN".

(2) Check a standby pump element for fuel flow, as follows:

(a) Set the collector tank jettison valve switch for the tank containing the pump under test to "OPEN".

(b) Close the LP isolation valve by setting the appropriate LP VALVE switch to "SHUT 1".

(c) Select an adjacent tank (on the same side of the aircraft) having room to receive the fuel flow from the pump and set its INLET VALVE switch to "OPEN".

NOTE: With this switch setting, when a standby pump is operated, fuel will be transferred to the chosen tank via the jettison valve and the trim transfer pipe.

(d) Set the appropriate ENGINE FEED PUMP switch to "ON". Check that the associated LOW PRESS caption is extinguished after 3 s as pump pressure builds up.

(e) Check that the quantity of fuel transferred is not less than 380 kg/min over a minimum period of 3 min.

(f) At the conclusion of the test:-

f1) Set the ENGINE FEED PUMPS switch to "OFF" and check that the associated LOW PRESS caption is illuminated after 3 s as pump pressure falls off.

f2) Set the INLET VALVE switch TO "SHUT".

R f3) Set the LP VALVE switch to "OPEN".

f4) Set the collector tank jettison valve switch to "SHUT".

(3) Refuel the collector tank to high level capacity (Ref. 12-11-28).

(4) Visually check the exterior of the pump unit over a period of 15 min. No leakage is permitted.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R (2) Refit the access panel.

R 3. Leakage Test - Pump Canister and Engine Feed Pipe
R (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Valve dummy element	E925117000
Fuel test rig	-
R Accumulator blanking tool/ test adapter with -	E925073030
R Union	AN 815-3
R Cap (pressure-sealing)	AN 929-3
R Container, 1.75 pints (1 l), for fuel leakage	-

B. Prepare

R (1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

R (2) Remove the appropriate tank access panel (Ref. Removal/Installation) to gain access to the canister inside the tank.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (5) Remove the pump element from the canister (Ref. Removal/Installation).

(6) Remove the associated collector tank jettison valve element (Ref. 28-31-11) and in its place fit the valve dummy element. Connect the fuel test rig supply line to the adapter on the element.

R (7) Fit the blanking tool/test adapter to the associated accumulator cover (Ref. 28-21-00, Adjustment/Test).

C. Test

R WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

R (1) Operate the fuel test rig and gradually fill the feed system pipeline with fuel. Permit the pipeline to bleed itself of air via the recirculation pressure holding valve and the accumulator bleed pipe.

R (2) Close the accumulator bleed at the blanking tool/test adapter.

R (3) Close the LP isolation valve by setting the appropriate LP VALVE switch to "SHUT 1".

R (4) Pressurize the engine feed pipe to 75 psig (5.17 bar). Maintaining the pressure, enter the tank and visually check that there is no leakage at the pipe connection to the canister.

R NOTE: There will be fuel leakage from the non-return valve; position a suitable container to collect fuel.

R (5) Reduce the pressure to 20 psig (1.38 bar), and check that the fuel leakage past the non-return valve does not exceed 378 cc/min.

R (6) At the completion of the check, release the rig pressure.

R (7) Refit the tank access panel in accordance with 57-00-00, Removal/Installation.

R (8) Refuel the tank (Ref. 12-11-28); check that there is no fuel leakage from the tank access panel.

R (9) Check that the fuel leakage past the canister fuel shut-off slide valve and flap valves does not exceed 83 cc/min.

R (10) Install the pump element in the canister (Ref. Removal/Installation) and check that there is no leakage from the joint between the canister and tank floor over a minimum period of 15 min.

D. Conclusion

(1) Disconnect the test rig, remove the valve dummy element and install the collector tank jettison valve element (Ref. 28=31=11, Removal/Installation).

(2) Set the LP VALVE switch to "OPEN".

R (3) Remove the accumulator blanking tool/test adapter and

fit the centre cover (Ref. 28-21-00, Adjustment/Test).

(4) Carry out an Operational Test of the pump element (Ref. para.2.).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Functional Test - Pump Non-return Valve

(1) To check that the valve has not failed shut and that it opens fully against its spring pressure when the pump is operating, carry out an Operational Test of the pump element (Ref. para.2.), ensuring that the fuel flow requirements are met.

(2) To check that the valve has not failed open and that it closes and seats correctly, carry out the Leakage Test detailed in paragraph 5.

5. Leakage Test - Pump Non-return Valve

A. Equipment and Materials

DESCRIPTION	PART NO.
Container, for fuel leakage	-

B. Prepare

(1) Check that the collector tank in which the pump is fitted contains sufficient fuel for the test. Refuel as necessary (Ref. 12-11-28).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Remove the appropriate access panel (Ref. Fig. 501).

(5) Remove the pump element (Ref. Removal/Installation).

C. Test

(1) Set the associated LP VALVE switch to "SHUT 1".

R (2) Run a standby pump in the collector tank by setting the appropriate PUMP switch to "ON". Check that the LOW PRESS caption is extinguished as pump pressure builds up.

R (3) Check that the fuel leakage past the non-return valve does not exceed 378 cc/min. Position a suitable container to collect the fuel.

R (4) Set the PUMP switch to "OFF".

R D. Conclusion

R (1) Install the pump element in the canister (Ref. Removal/Installation).

R (2) Set the LP VALVE switch to "OPEN".

R (3) Carry out an Operational Test of the pump element (Ref. para.2.).

R (4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

PRESSURE SWITCH UNIT (ACCUMULATOR) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four accumulator pressure switch units, one for each engine feed system. Each unit is a double switch mounted in the under-wing fairing beneath the associated collector tank.

2. Pressure Switch (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 105 to 115 lbf in (1.186 to 1.299 mdaN)	-
Circuit breaker safety clips	-

B. Prepare

(1) Isolate the electrical supply to the engine air starter motor by tripping the associated circuit breaker; fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 & 4 AIR START CONT	15-215	K181	C15
ENG 2 & 3 AIR START CONT	15-216	K182	D11

(2) Place a suitable warning placard on the engine starting panel indicating that the engine must not be run.

R (3) Ensure that the fuel accumulator is not pressurized from a ground air supply rig.

(4) Electrically isolate the switch unit and the engine feed pumps in the associated collector tank by tripping the appropriate circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 ACCUM IND	15-215	1Q761	F22
ENG 2 ACCUM IND	15-216	2Q761	E3
ENG 3 ACCUM IND	15-215	3Q761	F23
ENG 4 ACCUM IND	15-216	4Q761	E4
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q835	F5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q836	D1
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q835	B5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q836	F4
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q835	A8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q836	G14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q835	F8
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q836	G16

(5) Remove the appropriate access panel in the under-wing fairing, to gain access to the switch unit.

C. Remove

(1) Disconnect the two electrical connectors from the switch unit.

(2) Disconnect the air and fuel pipes from the switch unit. Fit suitable blanks to the pipe ends.

(3) Remove the two bolts and washers that secure the switch unit to its mounting, and remove the switch.

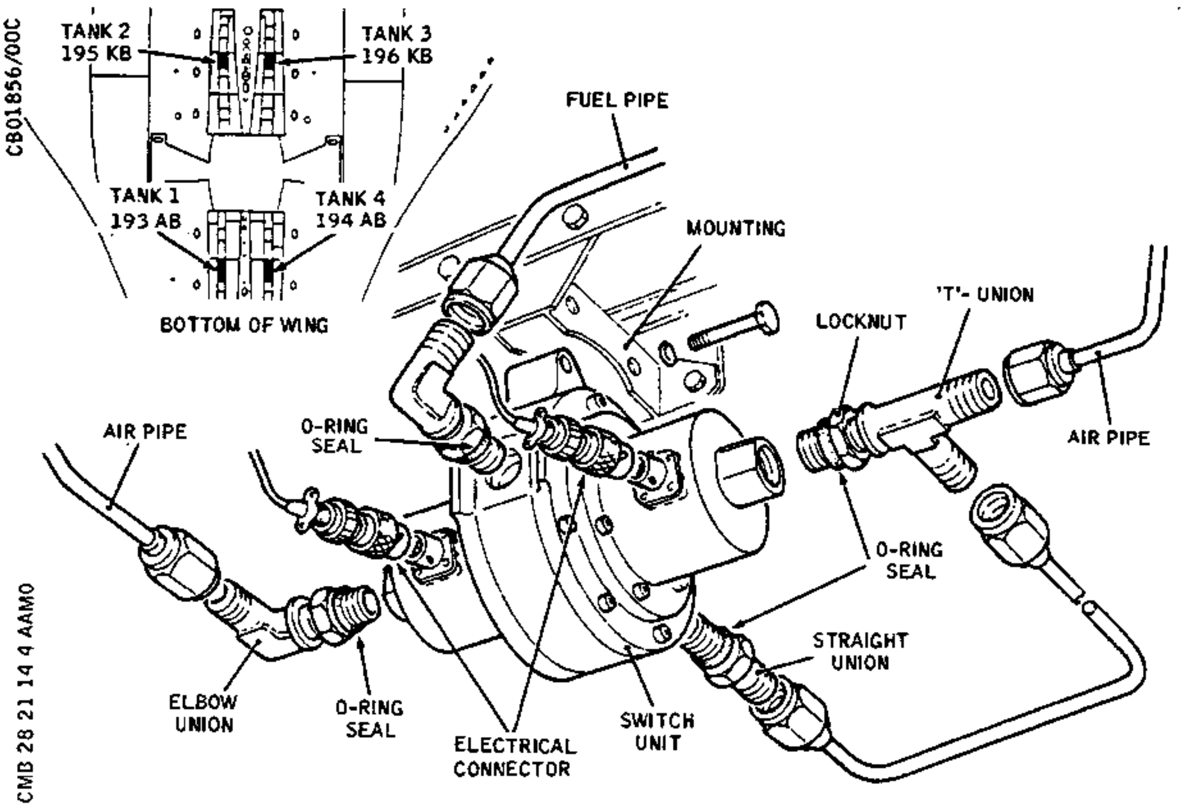
(4) Slacken the locknuts and unscrew the four unions from the switch. Discard the O-ring seals. Fit suitable blanks to the switch apertures.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the four unions. Fit the unions to the switch unit. Torque-tighten the straight union (where applicable) to between 105 and 115 lbf in (1.186 and 1.299 mdaN). Do not tighten the locknuts on the elbow unions at this stage.

(3) Secure the switch unit to its mounting bracket with the two bolts and washers, fitting the bolt with the dimpled head at the bonding position. Torque-tighten the bolts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).



R - Accumulator Pressure Switch Unit - Installation (Typical)
Figure 401

(4) Connect the fuel and air pipes to their respective unions to determine the correct orientation of the elbow unions. Secure the unions with their locknuts torque-tightened to between 105 and 115 lbf in (1.186 and 1.299 mdaN).

(5) Torque-tighten the pipe coupling nuts to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(6) Check that the electrical bonding is in accordance with 20-27-11.

(7) Connect the electrical connectors to the switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the safety clips and reset all circuit breakers previously tripped.

R (2) Carry out a Functional Test and a Leakage Test of
R the switch unit (Ref. Adjustment/Test).

PRESSURE SWITCH UNIT (ACCUMULATOR) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains the Functional Test, which must be carried out after a pressure switch has been installed. The test may be used at any time to check the integrity of the pressure switch system.

Operational and System Tests are not applicable in this instance.

2. Functional Test (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of supplying a pressure of 100 psig (6.9 bar)	-
Minilock coupling, for the air supply line	SAREM 711AB

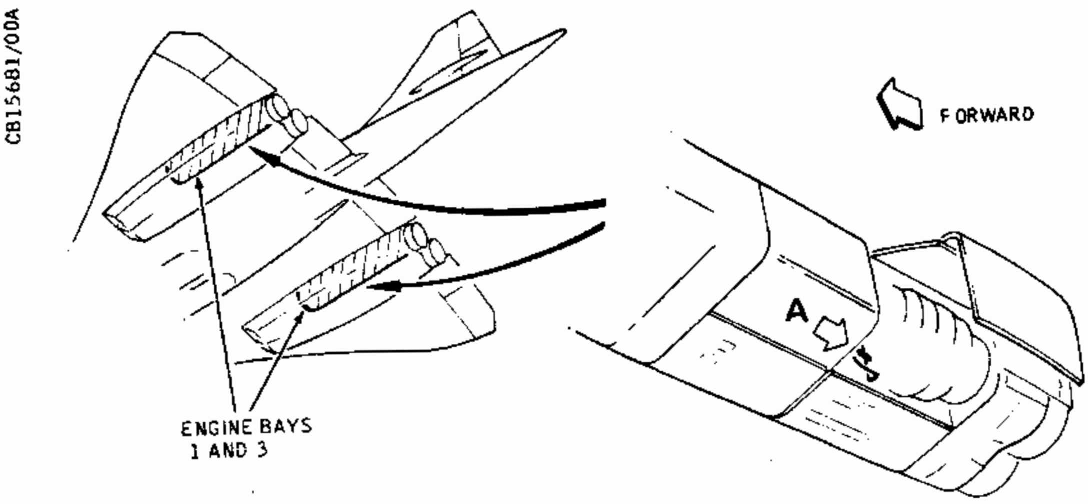
B. Prepare

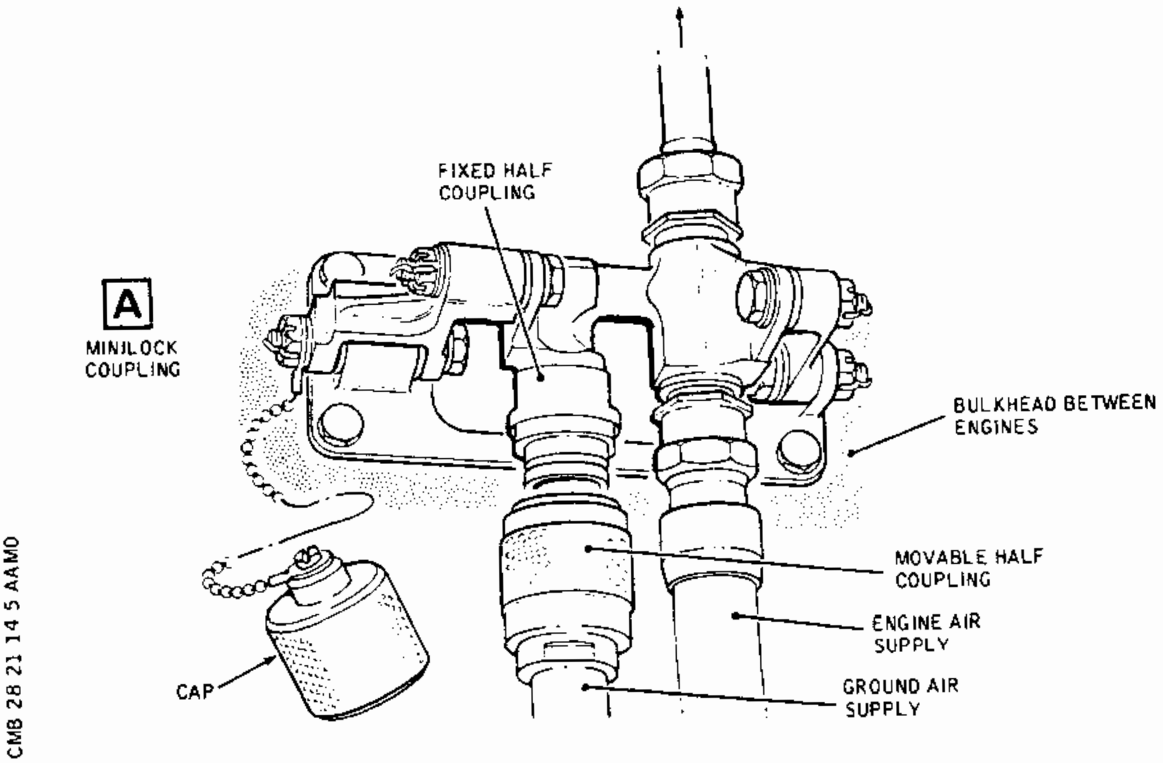
(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the associated tank contains at least 1,000 kg of fuel.

(4) Open the appropriate (No.1 or No.3) engine bay rear door to the servicing position (Ref. 71-00-00, Servicing), to gain access to the fuel/hydraulic ground air charging (self-sealing) Minilock coupling (Ref. Fig. 501).





R - Fuel/Hydraulic Ground Air Charging Coupling
Figure 501

(5) Remove the cap from the coupling and connect an air supply rig.

NOTE: Air pressure applied to the coupling in No.1 engine bay will pressurize the hydraulic reservoirs and tanks 1 and 2 accumulators. Air pressure applied to the coupling in No.3 engine bay will pressurize the hydraulic reservoirs and tanks 3 and 4 accumulators.

(6) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(7) Check that the ACC captions are illuminated.

C. Test

(1) Set the ENGINE FEED PUMP switches for the appropriate collector tank to "ON"; check that the LOW PRESS captions are extinguished as pump pressure builds up.

(2) Check that the ACC captions remain illuminated.

(3) Operate the air supply rig and pressurize the accumulator to 80 psig (5.52 bar); check that the appropriate ACC caption is extinguished.

(4) Set the ENGINE FEED PUMP switches to "OFF".

(5) Check that the ACC caption is illuminated.

(6) After 30 s, set the appropriate ENGINE FEED PUMP switches to "ON" and check that the ACC caption is extinguished 2 to 3 s later.

(7) With an air pressure of 80 psig (5.52 bar) applied and the ENGINE FEED PUMP switches at ON, check the fuel and air pipe connections on the switch for freedom from leakage.

(8) Set the ENGINE FEED PUMP switches to "OFF".

D. Conclusion

(1) Release the air pressure at the supply rig; disconnect the air supply line and refit the cap to the self-sealing coupling in the engine bay.

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(2) Close the engine bay door (Ref. 71-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

PUMP PRESSURE SWITCH - REMOVAL/INSTALLATION

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There is one pressure switch connected to each of the main,
R 1st standby and 2nd standby engine feed pumps in tanks 1, 2,
R 3 and 4. Each switch is bracket-mounted to the lower external
surface of the tank near the associated pump.

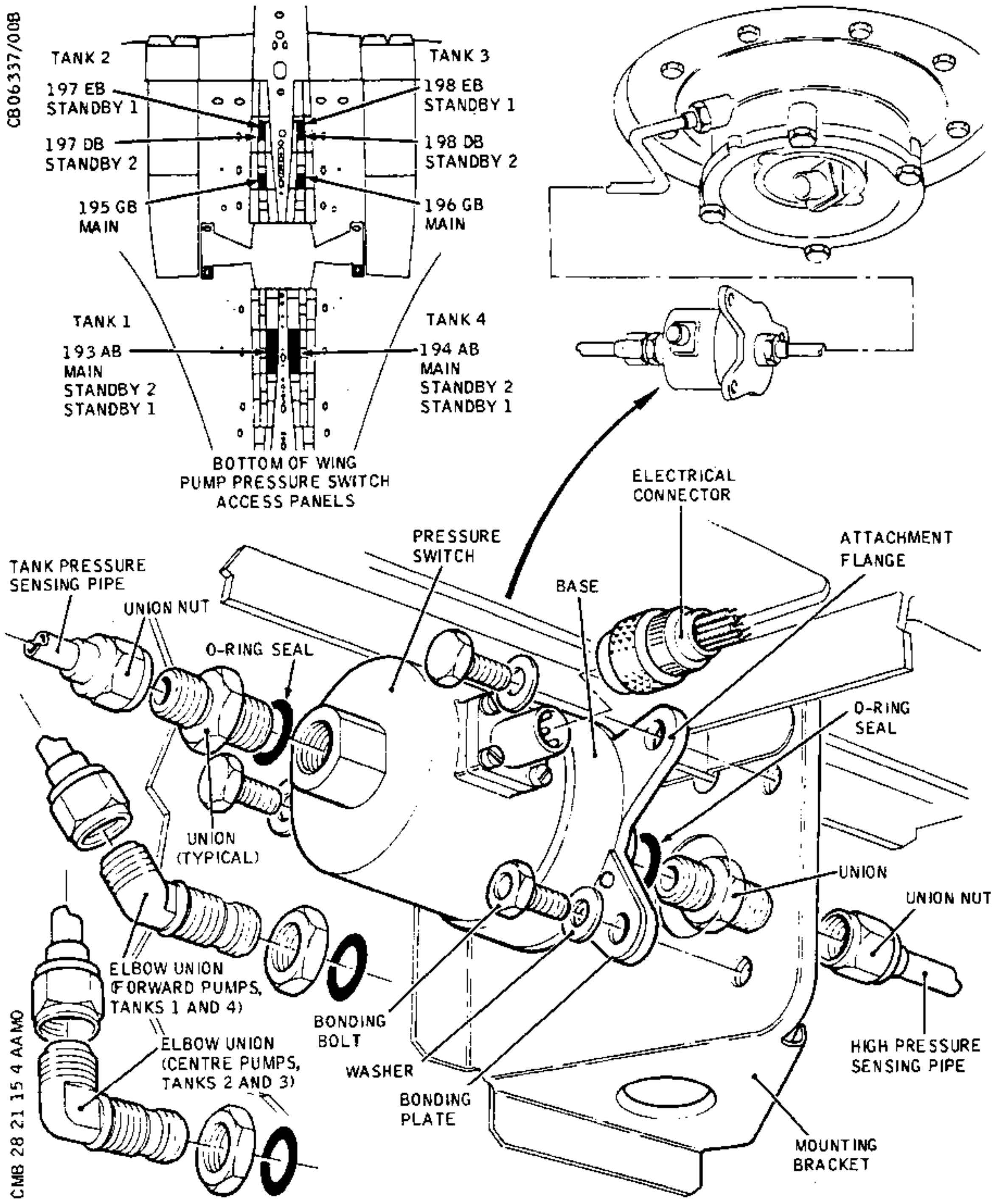
2. Pressure Switch (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Container, 1.75 pints (1 l), for fuel spillage	-

R B. Prepare

(1) Electrically isolate the pressure switch and the associated pump by tripping the appropriate circuit breakers; fit safety clips.



R Pump Pressure Switch - Installation
Figure 401

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Pumps			
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q835	F5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q836	D1
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q835	B5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q836	F4
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q835	A8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q836	G14
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q835	F8
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q836	G16
Pressure switches			
TANK 1 MAIN PUMP IND	15-216	1Q831	B1
TANK 1 ST'BY 1 PUMP IND	15-216	1Q832	B2
TANK 1 ST'BY 2 PUMP IND	15-216	1Q833	B3
TANK 2 MAIN PUMP IND	15-215	2Q831	B19
TANK 2 ST'BY 1 PUMP IND	15-215	2Q832	B20
TANK 2 ST'BY 2 PUMP IND	15-215	2Q833	B21
TANK 3 MAIN PUMP IND	15-216	3Q831	B4
TANK 3 ST'BY 1 PUMP IND	15-216	3Q832	B5
TANK 3 ST'BY 2 PUMP IND	15-216	3Q833	B6

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 4 MAIN PUMP IND	15-215	4Q831	B22
TANK 4 ST'BY 1 PUMP IND	15-215	4Q832	B23
TANK 4 ST'BY 2 PUMP IND	15-215	4Q833	B24

(2) Remove the appropriate access panel (Ref. Fig. 401) to gain access to the pressure switch.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

NOTE: Before operation (2) a suitable container must be positioned to collect fuel which will flow from the disconnected pipes. The flow from the high pressure sensing pipe will be limited by a restrictor fitted in the elbow union at the pump outlet.

(2) Disconnect the pressure sensing pipes from each end of the switch and fit suitable blanks to the pipe.

(3) Remove the three bolts and washers which secure the pressure switch to the mounting bracket; note the position of the bonding plate on the switch attachment flange and the special bonding bolt.

(4) Remove the union and O-ring seal from each end of the pressure switch. Discard the O-ring seals and fit a suitable blank to each end of the switch.

D. Install

(1) Observe the fuel and electrical safety precautions.

(2) Remove the blank from each end of the pressure switch.

(3) Secure the pressure switch to the mounting bracket with the three bolts and washers, ensuring that the special bonding bolt and bonding plate are correctly positioned; torque-tighten each bolt to between 40

and 45 lbf in (0.452 and 0.508 mdaN).

(4) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the unions.

(5) Fit the union to the base of the pressure switch and torque-tighten it to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(6) At the other end of the pressure switch, fit the required union as follows:-

(a) Fit the straight union to the switch and torque-tighten it to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(b) Fit the elbow union and nut to the switch as detailed in 28-22-12, Figure 403 - 'Sensing Pipe-Adapter Installation'. Torque-tighten the nut to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(7) Remove the blanks from the pressure sensing pipes and connect the pipes to the pressure switch.

(8) At the base of the switch, torque-tighten the pipe union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(9) At the other end of the switch, torque-tighten the pipe union nut to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(10) Ensure that the electrical bonding is in accordance with 20-27-11.

(11) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers previously tripped.

(2) Carry out an Operational Test and a Leakage Test of the switch (Ref. Adjustment/Test).

(3) Refit the access panel.

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PUMP PRESSURE SWITCH - ADJUSTMENT/TEST

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

R These pressure switches are associated with the main, 1st standby and 2nd standby pump units fitted to tanks 1, 2, 3 and 4. The pump control switch, fuel quantity indicator and low pressure caption are located on the fuel management panel.

R This topic comprises an Operational Test and a Leakage Test. Functional and System Tests are not applicable.

R 2. Operational Test

R A. Prepare

R (1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (2) Make available electrical ground power as detailed in 24-41-00.

R (3) Check that all engine feed pump LOW PRESS captions are illuminated.

R (4) Ensure that the tank to which the pressure switch is connected contains at least 1,000 kg of fuel, as shown on the appropriate fuel quantity indicator.

R B. Test

R (1) Set the associated ENGINE FEED PUMPS switch (Ref. 28-21-13, Adjustment/Test, Fig.501) to "ON". Check that the LOW PRESS caption is extinguished within 3 s as pump pressure builds up.

R (2) Simulate a failure in the pump by tripping its associated circuit breaker. Check that the pump LOW PRESS caption is illuminated.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
R TANK 1 ST'BY 1 PUMP SUP	4-213	1Q835	F5
R TANK 1 ST'BY 2 PUMP SUP	13-216	1Q836	D1
R TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
R TANK 2 ST'BY 1 PUMP SUP	4-213	2Q835	B5
R TANK 2 ST'BY 2 PUMP SUP	14-216	2Q836	F4
R TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
R TANK 3 ST'BY 1 PUMP SUP	4-213	3Q835	A8
R TANK 3 ST'BY 2 PUMP SUP	14-215	3Q836	G14
R TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
R TANK 4 ST'BY 1 PUMP SUP	4-213	4Q835	F8
R TANK 4 ST'BY 2 PUMP SUP	13-215	4Q836	G16

R (3) Reset the circuit breaker and check that the LOW PRESS
R caption is extinguished as pump pressure is regained.

R C. Conclusion

R (1) Set the pump switch to "OFF".

R (2) Switch off and disconnect electrical ground
R power as detailed in 24-41-00.

R 3. Leakage Test

R A. Prepare

R (1) Make available electrical ground power as detailed in
R 24-41-00.

R (2) Remove the appropriate panel (Ref. Removal/
R Installation) to gain access to the switch.

R (3) Check that the tank with which the pressure switch is associated contains at least 1,000 kg of fuel.

R B. Test

R (1) Set the associated ENGINE FEED PUMPS switch to "ON".

R (2) Check that there is no leakage from the pressure switch over a period of 5 min.

R C. Conclusion

R (1) Set the ENGINE FEED PUMPS switch to "OFF".

R (2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R (3) Refit the access panel.

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RECIRCULATION PRESSURE HOLDING VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The recirculation pressure holding valve for each engine feed system is located in the floor of the associated collector tank. Each valve element is directly accessible after removal of a valve cover plate in the wing bottom surface. The valve canister is in the tank interior and is accessible through the adjacent elliptical panel aperture. A valve element may be removed without draining the tank, because the fuel apertures in the valve canister automatically close when the valve is removed. Before removing a canister the tank must be drained. There are no electrical connections.

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2. Valve Element (Ref. Fig.401)

A. Equipment and Materials

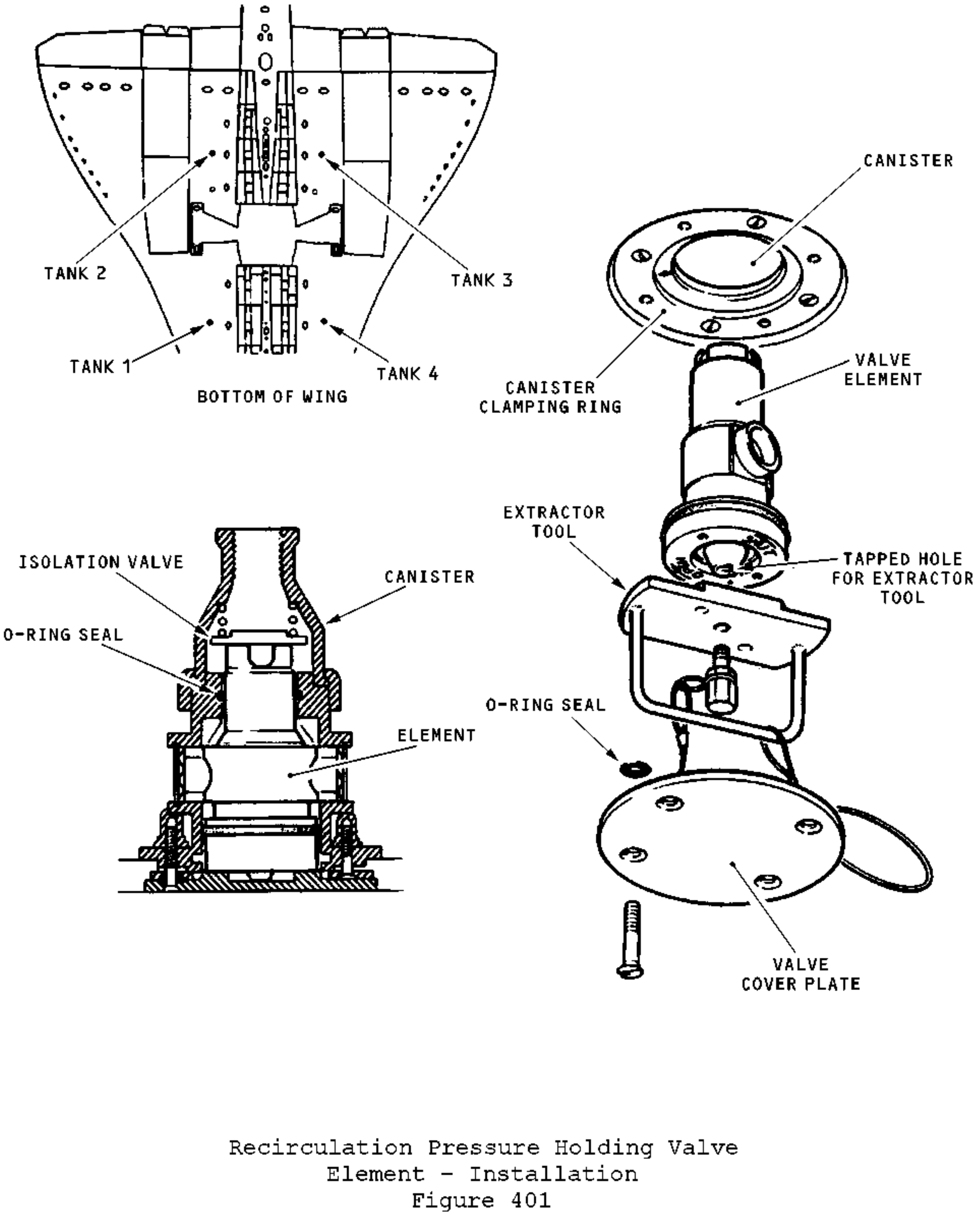
DESCRIPTION	PART NO.
Extractor, pressure holding valve element	D925094000
Torque screwdriver, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Remove Valve Element

(1) Remove the valve cover plate.

(2) Attach the extractor tool to the element and rotate the element through 90 deg in the SHUT direction, as indicated by the arrow, until the positional arrows on element and canister align. Withdraw the element from the canister and remove the tool.

NOTE: Rotation of the element closes the canister outlet ports.



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Recirculation Pressure Holding Valve
Element - Installation
Figure 401

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C. Install Valve Element

(1) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the canister, the valve element, and to each of the four attachment screws for the cover plate.

(2) Using the extractor tool, insert the element into the canister and rotate it through 90 deg in the OPEN direction, as indicated by the arrow, until the positional arrows align. Remove the extractor tool.

NOTE: Correct orientation of the element is determined by a locating dowel which enters a slot in the canister.

(3) After fitting the element ensure that the part of the valve with the tapped hole for the extractor tool is firmly seated on its circlip and has not been displaced upward.

(4) Fit the valve cover plate and torque-tighten the screws to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

D. Conclusion

(1) Carry out a Functional Test of the valve (Ref. 28-21-16, Adjustment/Test).

(2) With the valve immersed in fuel, check that there is no fuel leakage from the valve cover plate over a period of 15 min.

3. Valve Canister (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 445 to 455 lbf in (5.026 to 5.136 mdaN)	-
Torque screwdriver, 40 to 55 lbf in (0.452 to 0.621 mdaN)	-
After SB 28-018 For A/C 001-005,	
Sealant tools for removal/application of sealants, (Ref. 28-11-00, Approved Repairs - Sealants)	-

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DESCRIPTION	PART NO.
Sealants, etc.	-
PR1720R (Ref. 20-30-00, No.390)	-
PR1720SM (Ref. 20-30-00, No.351)	-
PR1720F (Ref. 20-30-00, No.352)	-
Cyclohexanone, for use with product No.390	-
Cleaning solvents	-
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
Halogenated hydrocarbon solvent R113 (Ref. 20-30-00, No.484)	-
RB Eurotwill cloth	-

B. Prepare to Remove Valve Canister

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Drain the collector tank in which the valve is fitted (Ref. 28-25-00, Servicing).

(3) Set the appropriate LP VALVE switch on the fuel management panel to "SHUT 1" and check that the associated magnetic indicator shows bar-across-line within 4 s.

(4) Remove the valve element (Ref. para.2.B.).

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(5) Drain the fuel trapped in the recirculation pipeline by depressing the isolating valve from its seating in the canister and allowing the fuel to drain into a 5 gal (20 l) container.

(6) Remove the appropriate access panel in the bottom of the tank.

C. Remove Valve Canister

Before SB 28-018

(1) Disconnect the bonding leads from the canister.

(2) Disconnect the recirculation pipe from the canister.

(3) Remove the four screws securing the clamping ring to the canister, and remove the ring and canister.

(4) Remove the union from the valve canister.

After SB 28-018 For A/C 001-005,

(1) Disconnect the bonding leads from the canister.

(2) Disconnect the recirculation pipe from the canister.

<u>WARNING</u>: SOLVENT 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC. R.113 IS TOXIC.

TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS WHEN USING CLEANING SOLVENTS.

(3) Remove the canister as follows:

(a) Remove the four screws securing the clamping ring to the canister. Remove the clamping ring.

(b) Using the sealant cutting tool and solvents, carefully separate the canister from the tank.

(c) Remove the canister from the tank.

(d) Thoroughly clean off any remaining sealants.

(4) Remove the union from the valve canister.

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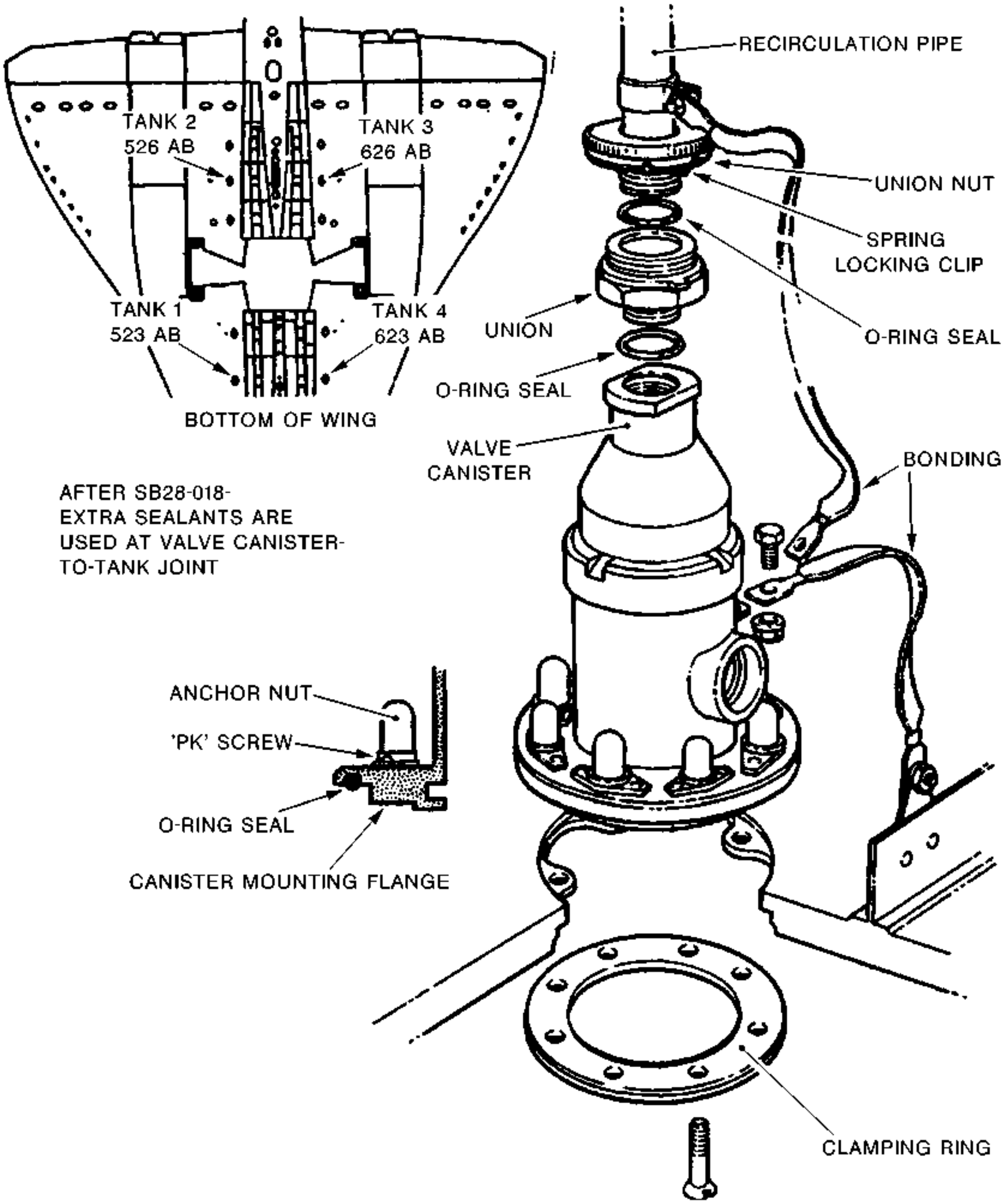

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Recirculation Pressure Holding Valve
Canister - Installation
Figure 402

D. Install Valve Canister

Before SB 28-018

(1) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the union and fit the union to the valve canister. Torque-tighten the union to between 445 and 455 lbf in (5.026 and 5.136 mdaN).

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the canister mounting flange.

(3) Place the canister in position and secure it with the clamping ring and four screws. Ensure that the axis of the outlet ports is at right angles to the stringers. Torque-tighten the screws to between 40 and 55 lbf in (0.452 and 0.621 mdaN).

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the recirculation pipe and connect the pipe to the canister in accordance with 20-23-21.

(5) Refit the bonding leads and check that the bonding is in accordance with 20-27-11.

After SB 28-018 For A/C 001-005,

(1) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the union and fit the union to the valve canister. Torque-tighten the union to between 445 and 455 lbf in (5.026 and 5.136 mdaN).

(2) Seal the anchor nut as follows:

(a) Noting the positions of the anchor nuts, remove the 'PK' screws securing the anchor nuts to the valve canister,

CAUTION: DO NOT ALLOW SEALANT TO ENTER THE ANCHOR NUTS.

(b) Apply sealant PR1720R (prefabricated tape) or PR1720SM (semi-paste/fluid) to the mating face of the anchor nuts and valve canister in accordance with 20-22-12.

(c) Refit the anchor nuts, with their 'PK' screws, to the positions from which they were removed.

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(3) Install the canister as follows:

(a) Fit a new, dry O-ring seal to the groove in the valve canister.

(b) Apply sealant PR1720R (prefabricated tape) or PR1720SM (Semi-paste/fluid) to the O-ring seal portion of the mounting flange in accordance with 20-22-12.

(c) Place the canister in position and secure it with the clamping ring and four screws. Ensure that the axis of the outlet ports is at right angles to the stringers. Torque-tighten the screws to between 40 and 55 lbf in (0.452 and 0.621 mdaN).

(d) Using sealant PR1720F (thick thixotropic paste), in accordance with 20-22-12, encapsulate the canister anchor nuts and top surface of the mounting flange. Allow the sealant to become tack-free, then apply an overcoating of sealant PR1720SM.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the recirculation pipe and connect the pipe to the canister in accordance with 20-23-21.

(5) Refit the bonding leads and check that the bonding is in accordance with 20-27-11.

E. Conclusion

(1) Carry out a Leakage Test of the recirculation lines as detailed in the system leakage test (Ref. 28-21-00, Adjustment/Test).

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Replace the access panel.

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R (4) Transfer sufficient fuel to immerse the canister and check that any leakage of fuel past the blanking sleeve does not exceed 76 cc/min.

R (5) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R (6) Install the valve element (Ref. para.2.C.).

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RECIRCULATION PRESSURE HOLDING VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This is a spring-operated valve acting against fuel pressure. There are no electrical controls or connections. To prove fuel flow through the valve, fuel is transferred from another collector tank to enable the fuel flow to be checked on the fuel quantity indicators.

This topic comprises an Operational Test, a Leakage Test, and a test at bench level, to check that the valve has not failed in the open condition.

Functional and System Test are not applicable.

2. Operational Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Ensure that the associated collector tank is at least 25 per cent empty and set the system CROSSFEED valve to open, and check that the indicator displays diagonal stripes and then bar-in-line.

(2) Ensure that any one of the remaining three collector tanks is at least 25 per cent full and set its system CROSSFEED valve to open and check that the indicator displays diagonal stripes and then bar-in-line.

R (3) Close LP Isolation valve by setting the appropriate L.P.
R valve switch to SHUT 1.

R (4) Set one of the tank ENGINE FEED PUMPS switches to "ON", checking that the LOW PRESS caption is extinguished after 2 s as pump pressure builds up.

NOTE: With this setting fuel will transfer from one tank to the other via the crossfeed, recirculation control and recirculation pressure holding valves.

R (5) Check, by reference to the fuel quantity indicators, that the rate of fuel flow into the associated collector tank is between 34 and 41 kg/min for a minimum period of 3 min.

C. Conclusion

(1) Set the ENGINE FEED PUMPS switches to "OFF".

(2) Set the CROSSFEED valve switches to "SHUT" and check that the indicators show diagonal stripes and then bar-across-line.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Valve Condition Test

NOTE: This test verifies that the valve has not failed open.

A. Equipment and Materials

DESCRIPTION	PART NO.
Probe, at least 6 in (152 mm) in length, of material no harder than aluminium BSL31	-
Clean fuel supply	-

B. Prepare

(1) Remove the valve element (Ref. Removal/Installation).

C. Test

NOTE: It is not possible to check visually at the outlet port that the valve is fully seated, because the skirt of the piston obscures the view.

The valve must be tested when still wet with fuel.

R (1) Check visually, at the inlet port, that the piston is fully seated.

R (2) With one hand partially sealing the inlet port, orally blow gently into the inlet port. Check that air pressure builds up and is not leaking from the outlet ports.

R (3) Using the probe, operate the piston. Check that the piston operates smoothly over its range of travel and can be heard to return to the valve seat.

R NOTE: The nominal range of travel is 0.140 in (3.556 mm) and the spring loading at the piston is between 1.30 and 1.85 lbf (5.783 and 8.229 N).

R D. Conclusion

R (1) Thoroughly rinse the valve in clean fuel.

R (2) Refit the valve element (Ref. Removal/Installation).

R 4. Leakage Test

A. Test

(1) Check the valve canister joints for leakage by carrying out the leakage test for the recirculation pipeline given in 28-21-00, Adjustment/Test.

(2) With the valve element removed (Ref. Removal/Installation) and the collector tank filled with fuel, check that any leakage from the canister
R blanking sleeve does not exceed 0.1 gal/h (Imp.) (0.45 l/h).

(3) With the element fitted (Ref. Removal/Installation), check that there is no external leakage over a period of 15 min.

CROSS-FEED VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four cross-feed valves, one for each engine feed system. Each valve is fitted to the forward sidewall of the system dry bay, where removal of the valve element is effected. Removal of the canister is effected from the interior of the tank on the opposite side of the dry bay sidewall.

This topic comprises instructions for the removal and installation of the valve element and the isolation canister.

2. Valve Element

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Circuit breaker safety clips	-
Clean container, 0.5 gal (2.2 l), for fuel drainage	-

B. Prepare to Remove Valve Eelement

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Electrically isolate the cross-feed valve and the engine feed pumps in the associated collector tank by tripping the appropriate circuit breakers; fit

safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 CROSS-FEED VALVE SUP & IND	3-213	1Q41	B5
ENG 2 CROSS-FEED VALVE SUP & IND	1-213	2Q41	K11
ENG 3 CROSS-FEED VALVE SUP & IND	1-213	3Q41	K12
ENG 4 CROSS-FEED VALVE SUP & IND	3-213	4Q41	B6
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q835	F5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q836	D1
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q835	B5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q836	F4
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q835	A8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q836	G14
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q835	F8

R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q836	G16

R (3) Remove the appropriate access panel from the top of the dry bay (Ref. Fig. 401).

R C. Remove Valve Element (Ref. Fig. 401)

R (1) Disconnect the electrical connector from the valve.

R (2) Disconnect the valve bonding lead.

R (3) Slacken the drain plug to facilitate subsequent removal.

R CAUTION: DO NOT SLACKEN THE CLAMP NUTS MORE THAN TWO TURNS OR THE WIRE STOPS IN THE STUDS MAY BE DAMAGED.

R (4) Slacken the three clamp nuts securing the valve body by not more than two turns and rotate the valve clockwise through 90 deg.

R NOTE: Rotation of the valve also rotates the spherical liner to seal the canister ports. The spherical liner must not be moved by hand.

R (5) Unscrew the drain plug and drain fuel from the valve interior into a clean canister. The quantity of fuel to be drained will be approximately 2 pints (1.1 l).

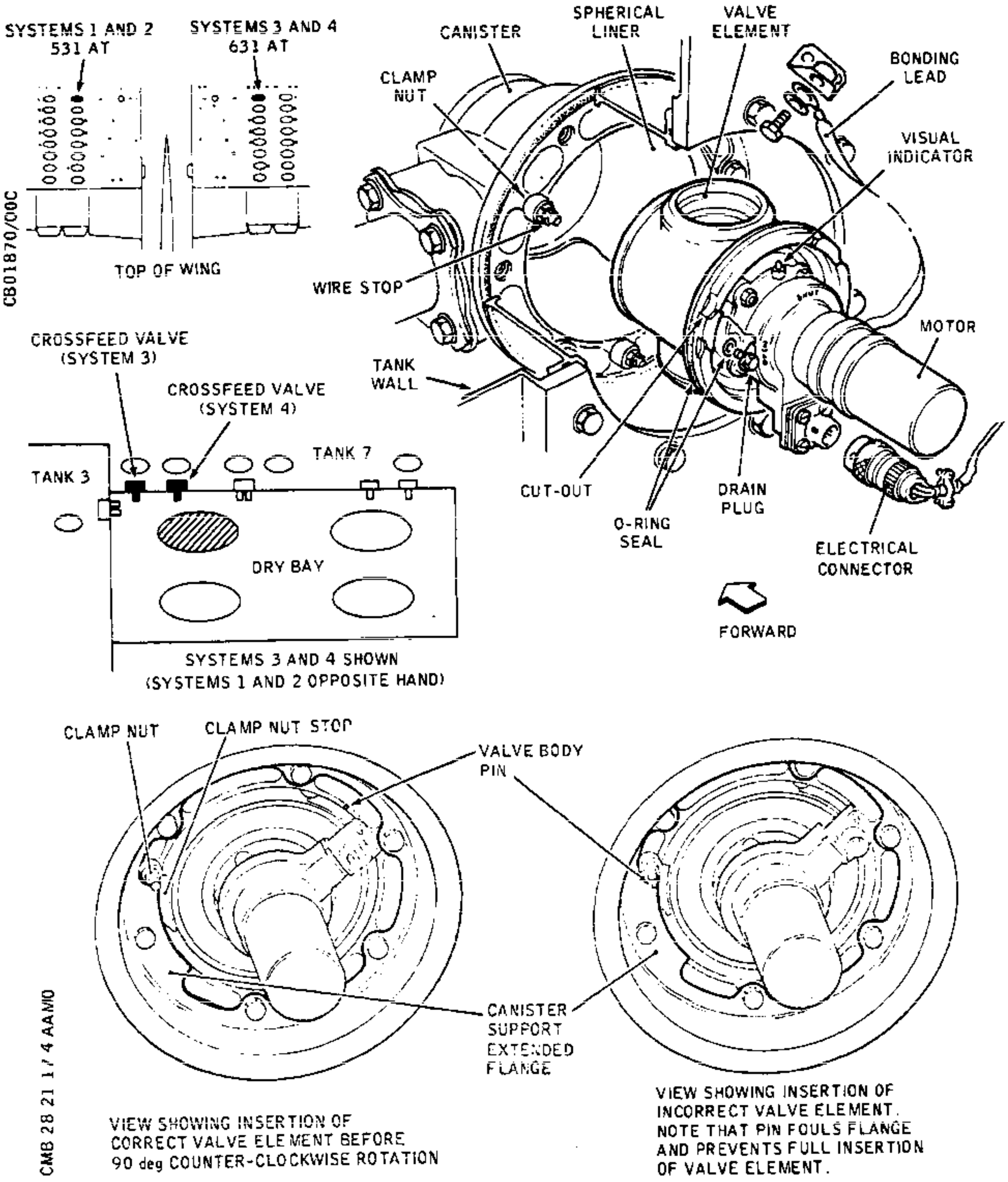
R (6) Align the cut-outs in the valve with the clamp nuts and withdraw the valve from the canister. Refit the drain plug.

R (7) Fit a suitable blank to the canister aperture.

R D. Install Valve Element (Ref. Fig. 401)

R (1) Comply with the fuel and electrical safety precautions.

R (2) Fit a new O-ring seal, lubricated in accordance



- Cross-feed Valve Element - Installation
Figure 401

R

with 20-23-11, to the valve.

(3) Remove the drain plug from the valve and fit a new O-ring seal, lubricated in accordance with 20-23-11.

(4) Fit the drain plug to the valve and screw it in, finger-tight only.

(5) Remove the blank from the canister aperture.

(6) Insert the valve into the canister.

R NOTE: The cross-feed valve element is similar to
R a 2 in refuel valve element. The refuel valve
R element is fitted with a non-return valve,
R but the cross-feed valve element does not
R have a non-return valve. Therefore, a small
pin on the periphery of the valve body ensures installation of the correct valve element. If the pin fouls against an extension of the top flange in the canister support (Ref. Fig. 401) an incorrect valve element is being used.

(7) With the valve fully seated, rotate it counter-clockwise through 90 deg to align the valve cut-outs with the clamp nuts. Secure the valve with the clamp nuts, torque-tightening each nut to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

NOTE: Rotation of the valve also rotates the spherical liner to open the canister ports.

(8) Torque-tighten the drain plug to between 10 and 14 lbf in (0.113 and 0.158 mdaN).

(9) Connect the valve bonding lead and check that the electrical bonding is in accordance with 20-27-11.

(10) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the placard from the fuel management panel.

(2) Reset the circuit breakers tripped before removal.

(3) Carry out a Functional Test and a Leakage Test of the valve (Ref. Adjustment/Test).

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3. Isolation Canister

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque-spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN).	-

B. Prepare to Remove Isolation Canister

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Drain the tank (Ref. 28-25-00, Servicing) in which the canister is fitted (tank 6, LH side; tank 7, RH side).

(3) Electrically isolate the engine feed pumps in the associated collector tank by tripping the appropriate circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 MAIN PUMP SUP	1-213	1Q834	J3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q835	F5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q836	D1
TANK 2 MAIN PUMP SUP	1-213	2Q834	L3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q835	B5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q836	F4
TANK 3 MAIN PUMP SUP	1-213	3Q834	N3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q835	A8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q836	G14

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 4 MAIN PUMP SUP	1-213	4Q834	Q3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q835	F8
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q836	G16

(4) On the fuel management panel, set the CROSSFEED switch of the valve to be removed to open (in-line) and the CROSSFEED switches for the remaining three valves to closed (cross-line).

NOTE: This will permit the cross-feed pipe to be drained, together with the engine feed pipe.

(5) Drain the fuel from the engine feed and the cross-feed pipes in which the valve is fitted (Ref. 28-21-00, Servicing).

(6) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(7) Remove the valve element (Ref. para.2.).

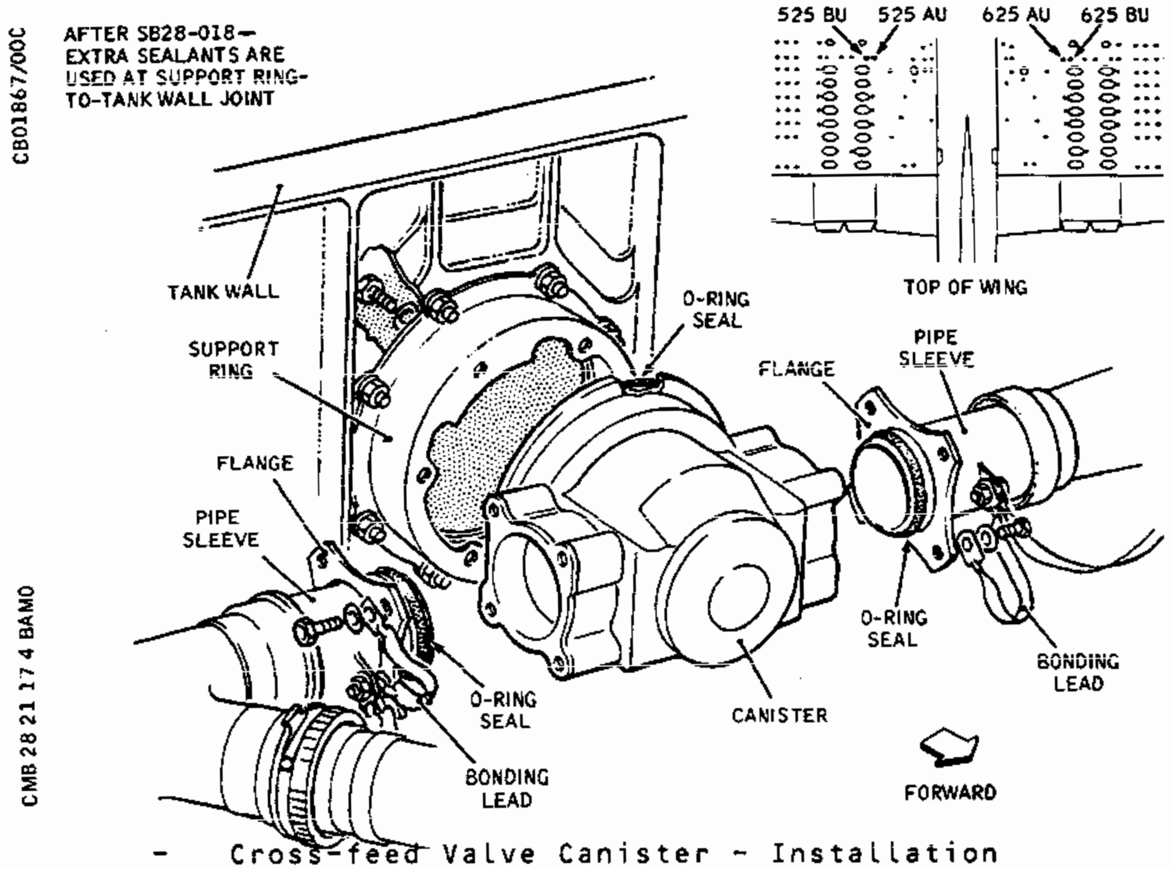
C. Remove Isolation Canister (Ref. Fig. 402)

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Remove the access panel from tank 6 or 7, as appropriate, to gain access to the canister to be removed.

(2) Remove the bolted flange from each side of the canister by removing the four attachment bolts; slide the flanges, complete with circlips, along the bodies of the adjoining pipe sleeves.

(3) Remove the six bolts securing the canister to its support ring and disengage and remove the canister from its associated pipe sleeves.



R - Cross-feed Valve Canister - Installation
Figure 402

D. Install Isolation Canister (Ref. Fig. 402)

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the pipe sleeve ends.

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the joint face of the canister.

(4) Locate the canister on its support ring and insert the pipe sleeve ends into each side of the canister. Secure the canister to the support ring with the six bolts and washers. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Secure each pipe sleeve to the canister with the bolted flange, complete with circlip, using the four bolts and washers, and fit the bonding lead to the bolt with the dimpled head. Torque-tighten each

bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Check that all electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Reset the circuit breakers tripped before removal.

(2) Carry out a Leakage Test of the isolation canister (Ref. Adjustment/Test).

(3) Install the valve element (Ref. para.2.).

CROSS-FEED VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four cross-feed valves, one for each engine feed system, fitted to the forward sidewalls of the equipment bays above the engine nacelles.

The control switches and magnetic indicators for the valves are on the fuel management panel at the third crew member's station. A mechanical indicator is also fitted to each valve.

Access to a valve element and isolation canister is gained by removing panels in the wing top surface.

These procedures comprise a Functional Test of a crossfeed valve, a Leakage Test of a valve element and a Leakage Test of an isolation canister. Operational and System Tests are not applicable.

2. Functional Test

A. Prepare

(1) Remove the appropriate panel to gain access to the valve element (Ref. Removal/Installation).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Make available electrical ground power as detailed in 24-41-00, Servicing.

(4) Ensure, by reference to the fuel quantity indicators (FQIs) that the collector tank associated with the cross-feed valve under test contains at least 1,500 kg of fuel, and the other collector tanks have at least 1,000 kg capacity to receive fuel.

(5) Transfer fuel or defuel (Ref. 28-25-00, Servicing) as necessary.

(6) Record the collector tank fuel quantities.

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B. Test

(1) Set the CROSS-FEED valve switch for the valve under test to the open position (in-line with the flowline engraved on the panel). Check that:

(a) the associated magnetic indicator display changes from bar-across-line to diagonal stripes, and then to bar-in-line within 2 s of the operation of the switch and

(b) the mechanical indicator on the valve is at OPEN.

(2) Set the CROSS-FEED valve switch to the shut position (cross-line to the flowline on the panel). Check that:

(a) the magnetic indicator display changes from bar-in-line to diagonal stripes, and then to bar-across-line within 2 s of the operation of the switch and

(b) the mechanical indicator on the valve is at SHUT.

(3) Shut the LP shut-off valve for the collector tank associated with the cross-feed valve under test by setting the appropriate LP VALVE switch to "SHUT 1".

(4) Check that the cross-feed valve under test magnetic indicator displays bar-across-line and set the other three cross-feed valve switches to the open position, checking that their magnetic indicators display bar-in-line.

(5) Set the three ENGINE FEED PUMPS switches of the associated collector tank to "ON".

(6) Check, by reference to the FQIs, that no fuel transfer takes place over a minimum period of 5 min.

(7) Proceed as follows in order to test the flow rate of fuel through the valve:

<u>NOTE</u>: In this test, fuel is pumped into the receiving tanks via the associated engine feed recirculation systems.

(a) Set the switch for the cross-feed valve under test to the open (in-line) position for 10 min and then set it to the shut (across-line) position.

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(b) Check, by reference to the FQIs, that the quantity of fuel transferred from the associated collector tank to the other collector tanks is not less than the following minimum flow rates:

Into each of tanks 1 and 4: 38 kg/min

Into each of tanks 2 and 3: 48 kg/min.

(c) Set the ENGINE FEED PUMPS switch to "OFF".

(d) Set all CROSS-FEED valve switches to the closed (across-line) position.

(e) Set the LP VALVE switch to "OPEN".

(8) Proceed as follows in order to test the reverse flow rate of fuel through the valve:

NOTE: In this test, fuel is pumped back into the associated collector tank from another selected collector tank via the cross-feed valve and recirculation systems.

(a) Shut the LP shut-off valve for the selected collector tank (not the tank associated with the cross-feed valve under test) by setting the appropriate LP VALVE switch to "SHUT 1".

(b) Set the CROSS-FEED valve switches for the selected collector tank and the one under test, to the open (in-line) position.

(c) Set the three ENGINE FEED PUMPS switches for the selected collector tank to "ON".

(d) After 10 min, set the ENGINE FEED PUMP switches to "OFF" and the CROSS-FEED valves switches to the closed (across-line) position.

(e) Check, by reference to the FQIs, that the fuel quantity transferred is not less than the following minimum flow rates:

Into tank 1 or 4: 38 kg/min

Into tank 2 or 3: 48 kg/min.

(f) Set the LP VALVE switch to "OPEN".

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C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(2) With power off, check that the CROSS-FEED valve magnetic indicator displays diagonal stripes.

(3) Refit the access panel.

3. Leakage Test - Valve Element

A. Prepare

(1) Remove the appropriate panel to gain access to the valve element (Ref. Removal/Installation).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Check that the associated collector tank contains a minimum of 1,000 kg of fuel as shown on the tank FQI on the fuel management panel. Refuel (Ref. 12-11-28) if necessary.

B. Test

(1) Set the CROSS-FEED valve switch to the open position (in-line).

(2) Set one of the associated collector tank ENGINE FEED PUMPS switches to "ON". Check that there is no leakage of fuel from the valve over a period of not less than 5 min.

(3) Set the ENGINE FEED PUMPS switch to "OFF".

(4) Set the CROSS-FEED valve switch to the shut position (across-line).

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(2) Refit the access panel.

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4. Leakage Test - Isolation Canister

A. Prepare

(1) Drain the tank (Ref. 28-25-00, Servicing) in which the canister is fitted (tank 6, LH side: tank 7, RH side).

(2) Remove the tank access panel (Ref. Removal/Installation) and prepare the tank for entry (Ref. 28-10-00, Servicing).

(3) Check that the associated collector tank contains a minimum of 1,000 kg of fuel as shown on the tank FQI. Refuel (Ref. 12-11-28) if necessary.

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B. Test

(1) Set the CROSS-FEED valve switch to the open position (in-line).

(2) Set one of the associated collector tank ENGINE FEED PUMPS switches to "ON".

(3) Enter the tank and check that, over a minimum period of 5 min, there is no fuel leakage from the canister-to-pipe and canister-to-tank joints.

(4) Set the ENGINE FEED PUMPS switch to "OFF".

(5) Set the CROSS-FEED valve switch to the shut position (across-line)

R (6) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (7) Refit the tank access panel.

R (8) Refuel tank 6 or 7 and the associated collector tank to high level (Ref. 12-11-28).

R (9) Remove the valve element (Ref. Removal/Installation).

R (10) Collect leakage from the canister in a clean container. Check that the fuel leakage does not exceed 7.6 cc/min.

C. Conclusion

(1) Install the valve element (Ref. Removal/Installation).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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ENGINE INLET FUEL PIPE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Each engine has a fuel feed pipe that connects the inlet side of the engine first stage fuel pump to a bulkhead connector in the wing dry bay above the engine.

The engine inlet fuel pipes in engine bays 1 and 3 are easily accessible for removal/installation. However, because of the engine bay centre wall, the access for the pipes in engine bays 2 and 4 is more difficult. Although, with the engines installed, it is technically feasible to remove and install the pipe in bays 2 and 4, it will probably be found expedient to lower the associated engine to improve access.

Because of different bulkhead fittings, the removal/installation procedures are under two separate headings, namely, 'Pipe - Engine 1 or 3' and 'Pipe - Engine 2 or 4'.

This topic also contains the information required to renew, in situ, seals in the expansion coupling of the engine inlet fuel pipe.

2. Pipe - Engine 1 or 3 (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 12 to 15 lbf in (0.135 to 0.169 mdaN)	-
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque spanner, 31 to 40 lbf in (0.35 to 0.45 mdaN)	-
Torque spanner, 47 to 57 lbf in (0.531 to 0.644 mdaN)	-

DESCRIPTION	PART NO.
Torque spanner, 53 to 62 lbf in (0.598 to 0.70 mdaN)	-
Torque spanner, 62 to 71 lbf in (0.70 to 0.80 mdaN)	-
Torque spanner, 85 to 125 lbf in (0.960 to 1.412 mdaN)	-
Torque spanner, 100 to 120 lbf in (1.13 to 1.356 mdaN)	-
Torque spanner, 490 to 510 lbf in (5.537 to 5.763 mdaN), for special nut at bulkhead connector	E925016000

B. Prepare to Remove Pipe - Engine 1 or 3

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

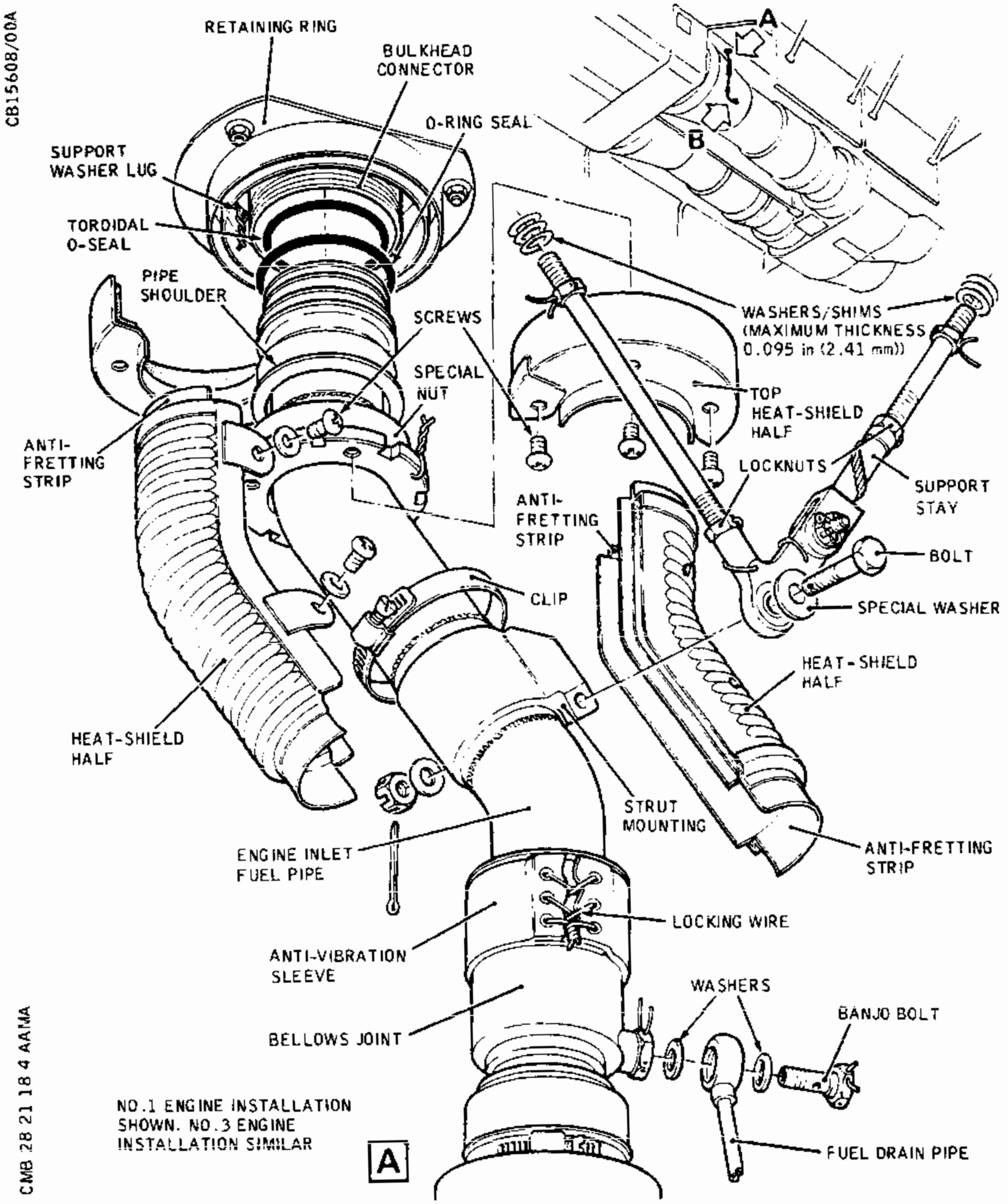
(2) Isolate the collector tank fuel supply by closing the system low-pressure fuel isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

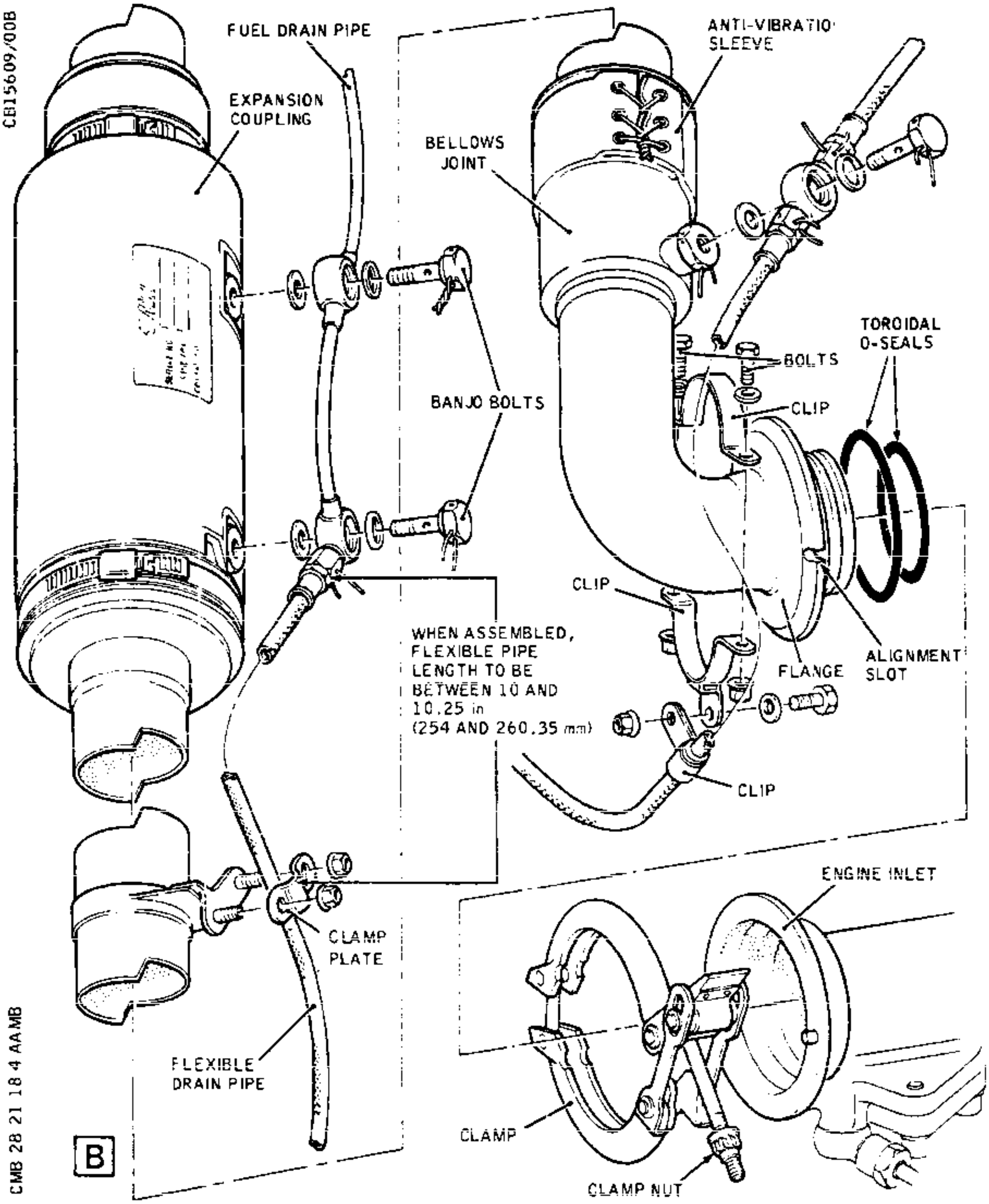
(b) On the fuel management panel set the LP VALVE switch for the associated engine feed system to "SHUT 1". Ensure that the associated indicator display changes to bar-across-line.

(c) Attach a placard to the fuel management panel to indicate that the fuel system is disassembled, and that no fuel management switch is to be operated.

(3) Trip the following associated circuit breakers and fit safety clips.



- Engines 1 and 3 Inlet Fuel Pipe - Installation
(Sheet 1 of 2)
Figure 401



- Engines 1 and 3 Inlet Fuel Pipe - Installation
(Sheet 2 of 2)
Figure 401

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 1 LP VALVE SUP 2	16-215	1Q2	-
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20

(4) Open the associated engine bay door (Ref. 71-00-00, Servicing - Engine Bay Door Lower and Side Panel Opening).

(5) Drain the pipe of fuel (Ref. 28-21-00, Servicing).

C. Remove Pipe - Engine 1 or 3

(1) Position the container under the pipe-to-engine joint.

(2) Unscrew the clamp nut sufficiently and disconnect the clamp.

(3) Gently ease the pipe away from the engine inlet. Allow residual fuel to drain into the container.

(4) Fit suitable blanks to the engine inlet and pipe. Remove the container.

(5) Remove the drain pipe clips, clamp and banjo bolts. Fit suitable blanks to the drain pipe and drain holes in the pipe.

(6) Suitably stow and secure the drain pipe.

(7) Remove the screws securing the top heat shield to the special nut. Remove the top heat shield.

(8) Remove the screws and clip from the other heat shield and remove the heat shield.

(9) Retain all items removed, for reinstallation.

(10) At the strut mounting, remove the split pin and unscrew the nut one turn only.

(11) Remove the locking wire and unscrew the special nut.

(12) Support the pipe and remove the nut, washers and bolt from the strut mounting and support stay.

(13) Gently ease the pipe away from the bulkhead connector.

(14) Fit suitable blanks to the bulkhead connector and pipe.

(15) Remove and discard the O-seals from each end of the pipe.

(16) Remove the anti-vibration sleeves from each bellows joint.

D. Install Pipe - Engine 1 or 3

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Fit new O-seals, lubricated in accordance with 20-23-11, to the pipe ends.

(4) Remove the blanks from the bulkhead connector and engine inlet.

(5) Lightly lubricate the threads of the bulkhead connector and shoulder of the pipe with petroleum jelly.

(6) Attach a suitable length of locking wire to the support washer lug.

(7) Insert the pipe-end into the bulkhead connector until the pipe shoulder abuts the bulkhead connector.

(8) Insert the other pipe-end into the engine inlet, ensuring that the slots in the flange are aligned with the engine inlet dowels. Loosely assemble the clamp.

(9) Align the strut mounting with the support stay and hand-tighten the special nut to the bulkhead connector.

(10) Using the special spanner, torque-tighten the special nut to between 490 and 510 lbf in (5.537 to 5.763 mdaN).

(11) Check that the bolt-holes in the strut mounting and support stay are in alignment. If the bolt-holes are not aligned, carry out the following:-

(a) At the support stay, unscrew the LH threaded locknuts.

NOTE: If the support stay rods need to be shortened or lengthened, it may necessitate removal or addition of shims/washers at the top end of the rods.

(b) Adjust the support stay rods until the bolt-holes in the strut mounting and support stay are aligned.

(c) Check, at the locknut end, that the rods are 'in safety'.

(d) If the rods are 'out of safety', increase the rod length by fitting the least number of washers/shims at the top of the rods. The total thickness of washers/shims must not exceed 0.095 in (2.41 mm).

(e) Repeat operations (b) and (c) as required.

(f) Torque-tighten the locknuts to between 53 and 62 lbf in (0.60 to 0.70 mdaN) in accordance with 20-21-11.

(g) Lock the locknuts with 22 s.w.g. locking wire.

(12) Secure the support stay to the strut mounting with the special washer, bolt, washer and nut. Torque-tighten the nut to between 100 and 120 lbf in (1.13 to 1.356 mdaN) in accordance with 20-21-11. Fit the split pin in accordance with 20-21-12.

(13) Lock the special nut to the lug provided on the support washer with 22 s.w.g. locking wire.

(14) Ensure, as far as is practicable, that the bellows joints are aligned.

(15) Complete the attachment of the pipe to the engine

inlet by torque-tightening the clamp nut to between 47 and 57 lbf in (0.531 and 0.644 mdaN).

(16) Check that the inlet fuel pipe is electrically bonded to structure and engine in accordance with 20-27-11.

(17) Remove the blanks from the fuel feed pipe drain bosses. Check the pipe for freedom from leaks by pressurizing the pipe via the engine feed pumps (Ref. Adjustment/Test).

(18) Assemble the heat-shield halves to the pipe, above the strut mounting, with the screws and clip.

(19) Position the top heat-shield halves in the annular channel of the retaining ring so that the top heat shields clamp around the other heat shield and the four screw-holes in the top heat shield are aligned with the screw-holes in the special nut.

(20) Secure the heat shields with the screws and clip. Torque-tighten the screws to between 12 and 15 lbf in (0.135 to 0.169 mdaN) and the clip to between 14 and 18 lbf in (0.158 to 0.203 mdaN). Wire-lock the clip in accordance with 20-21-13.

(21) Remove the blanks from the drain pipe. Secure the rigid part of the drain pipe to the fuel feed pipe with the banjo bolts and washers. Torque-tighten the banjo bolts to between 85 and 125 lbf in (0.960 and 1.412 mdaN). Lock the banjo bolts with 22 s.w.g. locking wire.

(22) Position the flexible part of the drain pipe so that the length of the pipe between the expansion coupling bottom banjo bolt and the securing clamp plate is between 10 and 10.25 in (254 and 260.35 mm). Secure the clamp plate with the nuts. Torque-tighten the nuts to between 31 and 40 lbf in (0.35 and 0.45 mdaN) in accordance with 20-21-11.

(23) Secure the flexible part of the drain pipe to the lower bellows joint with the banjo bolt and washers. Torque-tighten the banjo bolt to between 85 and 125 lbf in (0.960 and 1.412 mdaN). Lock the banjo bolt with 22 s.w.g. locking wire.

(24) Secure the drain pipe to the bottom of the fuel feed pipe with the clips, bolts, washers and nuts. Torque-tighten the nuts to between 62 and 71 lbf in

(0.70 and 0.80 mdaN) in accordance with 20-21-11.

(24) Fit the anti-vibration sleeves to each bellows joint, as follows:-

(a) Wrap the sleeve around the bellows, so that the eyelets face rearward.

(b) With no tension on the sleeve, measure and note the distance between the eyelets.

(c) Lace and tension the sleeve with locking wire so that the gap between the eyelets is reduced by 0.10 in (2.4 mm).

E. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) If the LP valve(s) were closed after the leak test, set the LP VALVE switch to "OPEN"; ensure that the associated indicator display changes to bar-in-line.

(3) Remove the placard from the fuel management panel.

(4) Ensure that all tools and equipment are removed from the engine bay and that the working area is clean and free from debris.

(5) Close the engine bay door (Ref. 71-00-00, Servicing - Engine Bay Door Lower and Side Panel Opening).

(6) Carry out a short engine ground run (Ref. 71-00-00, Adjustment/Test) to prove fuel flow through the inlet fuel pipe.

3. Pipe - Engine 2 or 4 (Ref. Fig. 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 31 to 40 lbf in (0.35 to 0.45 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.40 to 0.50 mdaN)	-

DESCRIPTION	PART NO.
Torque spanner, 40 to 65 lbf in (0.45 to 0.734 mdaN)	-
Torque spanner, 47 to 57 lbf in (0.531 to 0.644 mdaN)	-
Torque spanner, 62 to 71 lbf in (0.70 to 0.80 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.80 to 0.90 mdaN)	-
Torque spanner, 85 to 125 lbf in (0.960 to 1.412 mdaN)	-
Locking wire, 22 s.w.g., to Spec. DTD 189	-
Petroleum jelly (Ref. 20-30-00, No.27)	-
Container, 10 gal (45 l), for fuel spillage	-
Blank engine feed pipe	E925123000
Key, for access panel	E920132000

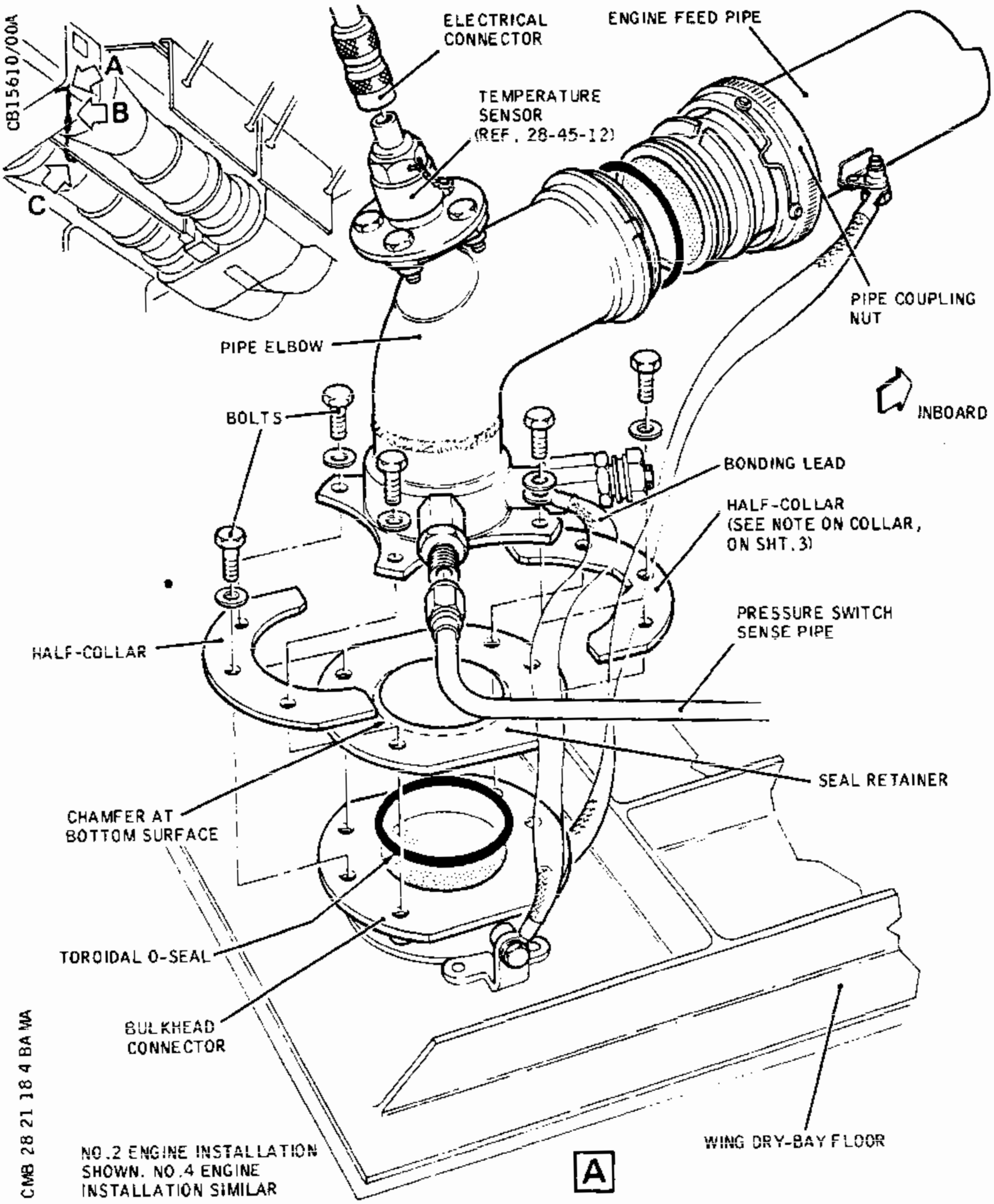
B. Prepare to Remove Pipe - Engine 2 or 4

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the collector tank fuel supply by closing the system low-pressure isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) On the fuel management panel, set the LP VALVE switch for the associated engine feed system to "SHUT 1". Ensure that the associated indicator display changes to bar-across-line.



\- Engines 2 and 4 Inlet Fuel Pipe - Installation
(Sheet 1 of 3)
Figure 402

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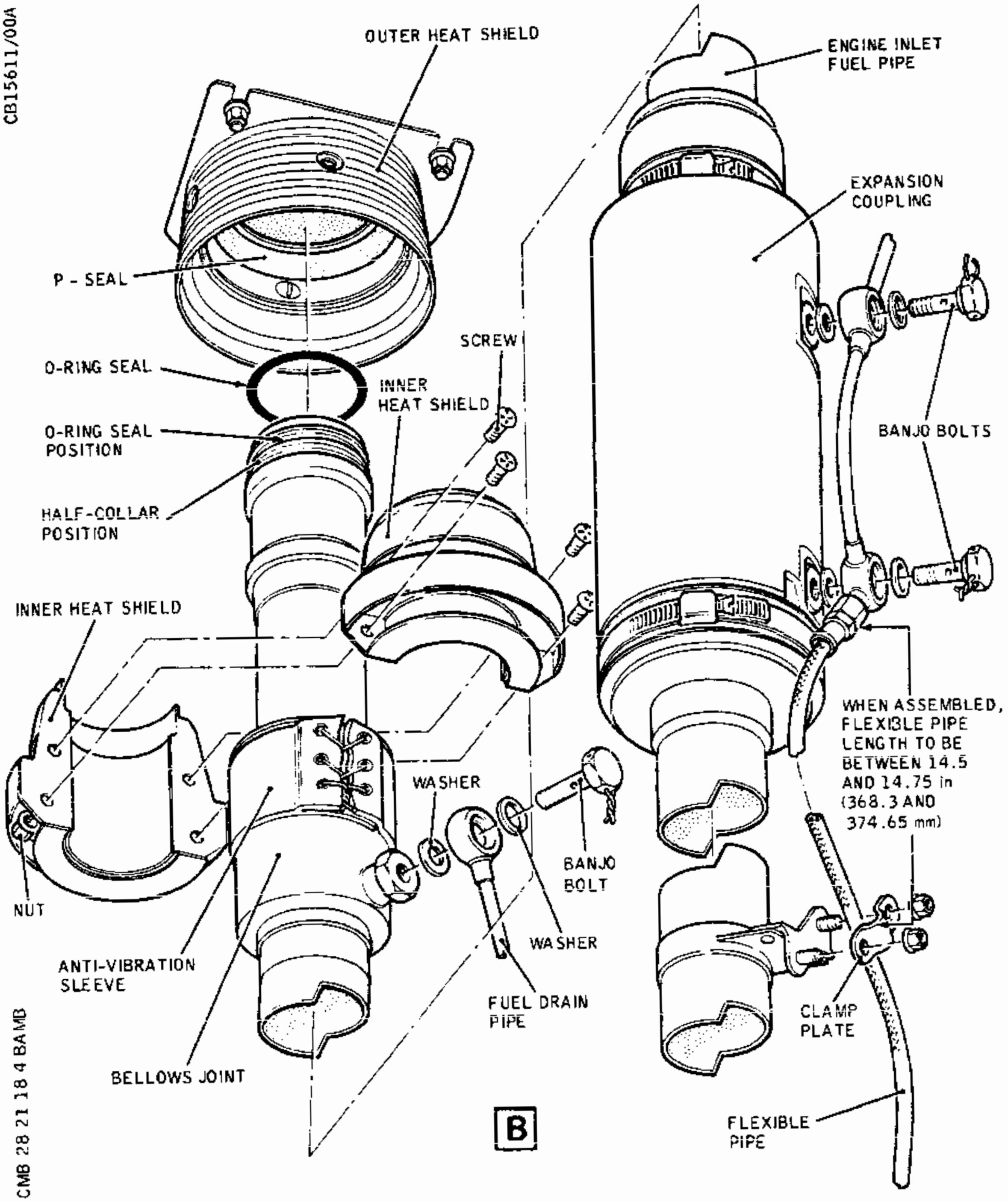

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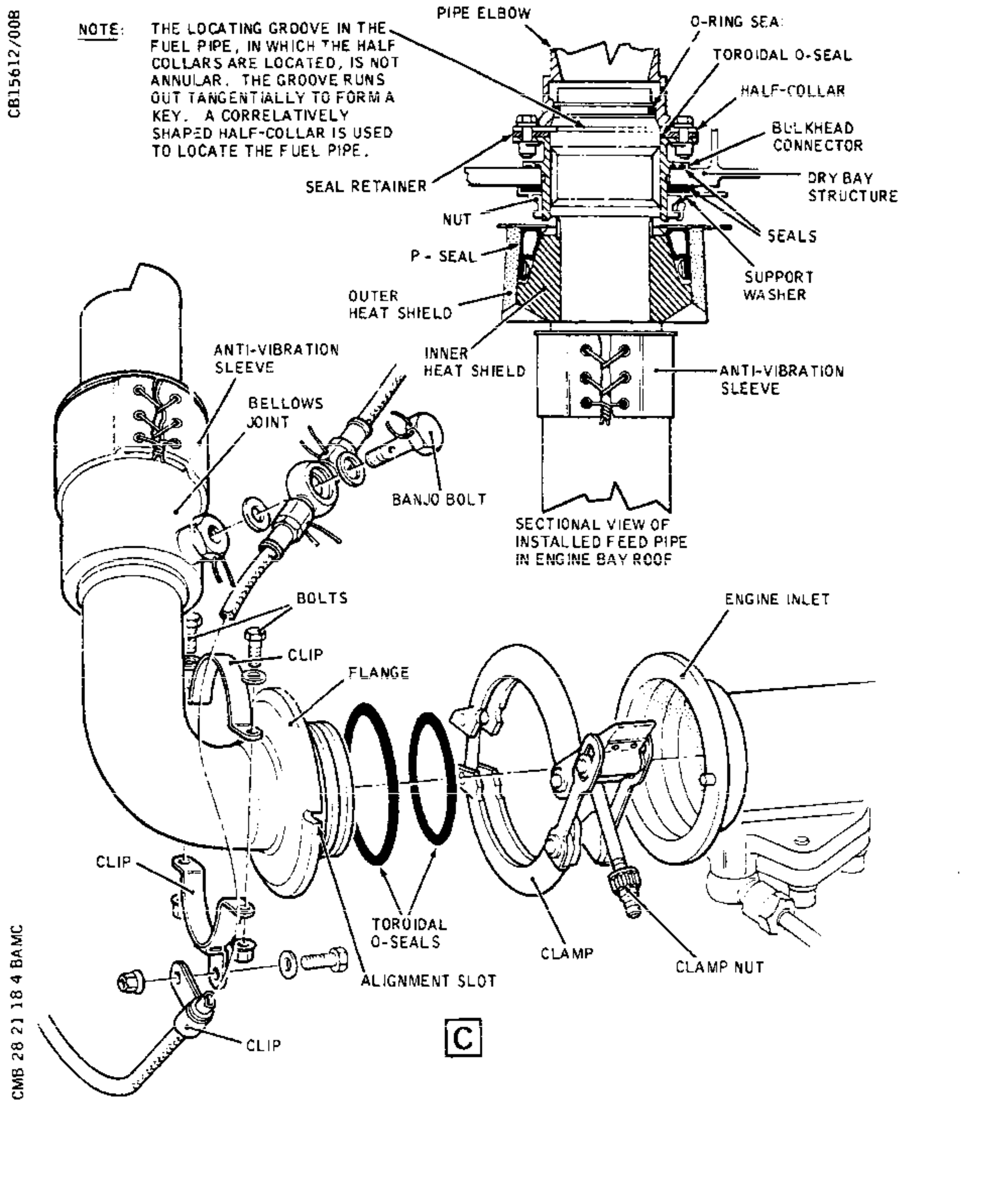
\- Engines 2 and 4 Inlet Fuel Pipe - Installation
(Sheet 2 of 3)
Figure 402



\- Engines 2 and 4 Inlet Fuel Pipe - Installation
(Sheet 3 of 3)
Figure 402

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(c) Attach a placard to the fuel management panel to indicate that the fuel system is disassembled, and that no fuel management switch is to be operated.

(3) Trip the following associated circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
ENG 4 LP VALVE SUP 2	16-215	4Q2	-

(4) Open the associated engine bay door (Ref. 71-00-00, Servicing - Engine Bay Door Lower and Side Panel Opening).

(5) Using the key, unlock and remove the associated access panel: engine 2, 531 BT; engine 4, 632 CT.

(6) Lower the associated engine (Ref. 71-00-12, Removal/Installation).

C. Remove Pipe - Engine 2 or 4

(1) Remove the drain pipe clips, clamp and banjo bolts. Fit suitable blanks to the drain pipe and drain holes in the pipe.

(2) Suitably stow and secure the drain pipe.

(3) In the dry bay disconnect the electrical connector from the temperature sensor in the pipe elbow.

(4) Disconnect the pressure switch sense pipe from the pipe elbow. Fit suitable blanks to the sense pipe and elbow.

(5) Disconnect the bonding leads from each end of the feed pipe.

(6) Unscrew the pipe coupling nuts at each end of the feed pipe.

(7) Remove the four bolts and washers that secure the pipe elbow to the bulkhead connector. Note the position of the bolt that secured a bonding lead.

(8) Gently manoeuvre the elbow upward until the feed pipe can be removed from a Y-junction pipe Remove the feed pipe. Remove the feed pipe and the elbow. Suitably blank the Y-junction pipe, feed pipe and elbow.

(9) In the engine bay, support the inlet fuel pipe.

(10) In the dry bay, remove the two bolts and washers that secure the half-collars.

(11) In the engine bay, push up on the inlet fuel pipe, and in the dry bay, remove the half-collars and seal retainer.

(12) Withdraw the inlet fuel pipe from the bulkhead connector and outer heat shield.

(13) Fit suitable blanks to the bulkhead connector and inlet fuel pipe.

(14) Remove and discard the O-seals from the inlet pipe.

(15) Remove the screws and nuts securing the inner heat shield to the inlet fuel pipe and remove the heat shield.

(16) Remove the anti-vibration sleeves from each bellows joint.

D. Install Pipe - Engine 2 or 4

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Fit the inner heat shield to the inlet fuel pipe with the screws and nuts. Torque-tighten the nuts to between 31 and 40 lbf in (0.35 to 0.45 mdaN) in accordance with 20-21-11.

(3) Remove the blanks from the top end of the inlet fuel pipe and the bulkhead connector.

(4) Lightly lubricate, with petroleum jelly, the cone

of the inner heat shield and the bore of the bulkhead connector.

(5) Position the inlet fuel pipe into the bulkhead connector so that the 'key-section' of the locating groove (Ref. Fig. 402) (See Note on Sheet 3) is facing toward the engine feed pipe.

(6) Secure the inlet fuel pipe to the bulkhead connector as follows:-

(a) Push and maintain a firm upward pressure on the inlet fuel pipe.

<u>NOTE</u>: The upward pressure must be maintained to compress the P-seal in the outer heat shield.

(b) From the dry bay, fit a new toroidal O-seal, lubricated with petroleum jelly, to the pipe end. Ensure that the O-seal is firmly positioned against the bulkhead connector.

(c) Fit the seal retainer, with its chamfer at the bottom surface, over the pipe end.

(d) Press down on the seal retainer, and slide the half-collars into the locating groove in the pipe end.

(e) Secure each half-collar with a bolt and washer. Torque-tighten the bolts to between 35 and 44 lbf in (0.40 to 0.50 mdaN) in accordance with 20-21-11.

(7) Fit a new O-ring seal, lubricated with petroleum jelly, to the pipe end.

(8) Remove the blanks from the pipe elbow, engine feed pipe and Y-junction pipe.

(9) Fit new O-seals, lubricated with petroleum jelly, to each end of the engine feed pipe.

(10) In situ, loosely assemble the engine feed pipe to the Y-junction pipe and pipe elbow.

(11) Align the pipe elbow with the bulkhead connector bolt-holes. Secure the pipe elbow with the washers, bolts, and bonding lead under the bonding bolt. Torque-tighten the bolts to between 71 and

80 lbf in (0.80 to 0.90 mdaN) in accordance with 20-21-11.

(12) Complete the installation of the engine feed pipe and coupling nuts in accordance with 20-23-21.

(13) Secure the bonding leads to the engine feed pipe in accordance with 20-27-11. Torque-tighten the bonding bolts to between 35 and 44 lbf in (0.40 to 0.50 mdaN) in accordance with 20-21-11.

(14) Check the installation for freedom from leaks, as follows:-

(a) Remove the storage blanks from the flanged end of the inlet fuel pipe and drain pipe bosses. Fit new toroidal O-seals, lubricated with petroleum jelly, to the flanged end of the inlet fuel pipe.

(b) Fit the test blank to the flanged end of the inlet fuel pipe with the clamp.

(c) Pressurize the pipe via the engine feed pumps (Ref. Adjustment/Test). During the first 2 min of pressurization, bleed air from the system by loosening a blanking plug in the test blank.

(d) After the leakage test, set the associated LP VALVE switch to "SHUT 1"; ensure that the valve indicator display changes to bar-across-line.

(e) Drain the fuel pipe into the container by removing the test blank.

(f) Temporarily fit storage blanks to the flanged end of the pipe and the drain pipe bosses.

(15) Install the engine (Ref. 71-00-12, Removal/Installation).

(16) Remove the storage blanks; fit new toroidal O-seals, lubricated with petroleum jelly, to the flanged end of the inlet fuel pipe.

(17) Insert the flanged end of the inlet fuel pipe into the engine inlet, ensuring that the slots in the flange are aligned with the engine inlet dowels. Loosely assemble the clamp.

(18) Ensure, as far as is practicable, that the bellows

joints are aligned.

(19) Complete the attachment of the pipe to the engine inlet by torque-tightening the clamp to between 47 and 57 lbf in (0.531 to 0.644 mdaN).

(20) Remove the blanks from the inlet fuel pipe drain bosses and drain pipes.

(21) Secure the rigid part of the drain pipe to the inlet fuel pipe with the banjo bolts and washers. Torque-tighten the banjo bolts to between 85 and 125 lbf in (0.960 to 1.412 mdaN). Lock the banjo bolts with 22 s.w.g. locking wire.

(22) Position the flexible part of the drain pipe so that the length of the pipe between the expansion coupling bottom banjo bolt and the securing clamp plate is between 14.5 in and 14.75 (368.30 and 374.65 mm). Secure the pipe in this position with the clamp plate and nuts. Torque-tighten the nuts to between 31 and 40 lbf in (0.35 to 0.45 mdaN) in accordance with 20-21-11.

(23) Secure the flexible part of the drain pipe to the lower bellows joint with the banjo bolt and washers. Torque-tighten the banjo bolt to between 85 and 125 lbf in (0.960 and 1.412 mdaN). Lock the banjo bolt with 22 s.w.g. locking wire.

(24) Secure the drain pipe to the bottom of the inlet fuel pipe with the clips, bolts, washers and nuts. Torque-tighten the nuts to between 62 and 71 lbf in (0.70 to 0.80 mdaN) in accordance with 20-21-11.

(25) Fit the anti-vibration sleeves to each bellows joint as follows:-

(a) Wrap the sleeve around the bellows so that the eyelets face rearward.

(b) With no tension on the sleeve, measure and note the distance between eyelets.

(c) Lace and tension the sleeve with locking wire so that the gap between the eyelets is reduced by 0.10 in (2.4 mm).

(26) Check that the inlet fuel pipe is electrically bonded to structure and engine in accordance with 20-27-11.

(27) Check the inlet fuel pipe-to-engine inlet connection for freedom from leaks by pressurizing the pipe via the engine feed pumps (Ref. Adjustment/Test).

E. Conclusion

(1) Ensure that the circuit breakers previously tripped are reset.

(2) Ensure that the LP VALVE switches are set to OPEN and their associated indicator displays bar-in-line.

(3) Remove the placard from the fuel management panel.

(4) Ensure that all tools and equipment are removed from the engine bay and dry bay, and that the working area is clean and free from debris.

(5) With the engine bay doors still open, carry out a short engine ground run (Ref. 71-00-00, Adjustment/Test) to prove all disconnected engine services. During the ground run, check the engine feed pipes in the dry bay and engine bay for freedom from leaks.

(6) Close the engine bay doors (Ref. 71-00-00, Servicing - Engine Bay Doors Lower and Side Panel Opening).

(7) Refit the associated access panel: Engine 2, 541 BT; engine 4, 632 CT.

4. Expansion Coupling Seal Renewal (Ref. Fig. 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Push-pull gauge, 0 to 200 lbf (0 to 890 N)	-
*Torque adapter, for use at top seal assembly (outer ringnut)	E925201000
*Torque adapter, for use at bottom seal assembly (ringnut)	E925205000

DESCRIPTION	PART NO.
R R *Torque spanner, 1/2 in (12.70 mm) square drive, for use with above (*) torque adapters, and set to produce torque of 100 to 120 lbf in (1.130 to 1.356 mdaN) at ringnuts	-
**Torque adapter, for use at top seal assembly (inner ringnut) and piston seal assembly (inner piston nut)	E925202000
**Torque adapter, for use at piston seal assembly (outer piston nut)	E925204000
R R **Torque spanner, 1/2 in (12.70 mm) square drive, for use with above (**) torque adapters, and set to produce torque of 80 to 100 lbf in (0.904 to 1.130 mdaN) at nuts	-
Ring spanner, for restraining piston	E925203000
Strap wrench, 1 to 6 in R (25.4 to 152.4 mm), for restraining upper fuel pipe support sleeve and outer sleeve	-
Syringe	-
Clean fuel	-
Petroleum jelly (Ref. 20-30-00, No.27)	-
Locking wire, 22 s.w.g., to Spec. DTD 189	-
New plastic bags, at least 12 x 6 in (304.8 x 152.4 mm), for protecting disassembled parts	-

DESCRIPTION	PART NO.
Clean, dry air supply	-

B. Prepare

CAUTION: DURING RENEWAL OF SEALS, THE IMMEDIATE LOCAL ENVIRONMENT MUST BE CLEAN, DRY AND 'STILL AIR'.

(1) Disconnect the inlet fuel pipe from the engine inlet and disconnect the drain pipe (Ref. para.2. or 3.).

NOTE: To renew seals in the expansion coupling of the No.2 or No.4 engine inlet fuel pipe, it will be necessary to lower the engine (Ref. 71-00-12).

C. Renew Seals

NOTE: During renewal, all seals and moving parts must be lubricated with petroleum jelly.

(1) Remove the clips securing the heat shield and remove the heat shield.

(2) At the top seal assembly, remove the locking wire and unscrew the outer ringnut.

(3) Pull down on the lower half of the pipe and remove the lower pipe, complete with outer sleeve, piston seal assembly and bottom seal assembly.

(4) Suitably protect the open end of the upper fuel pipe.

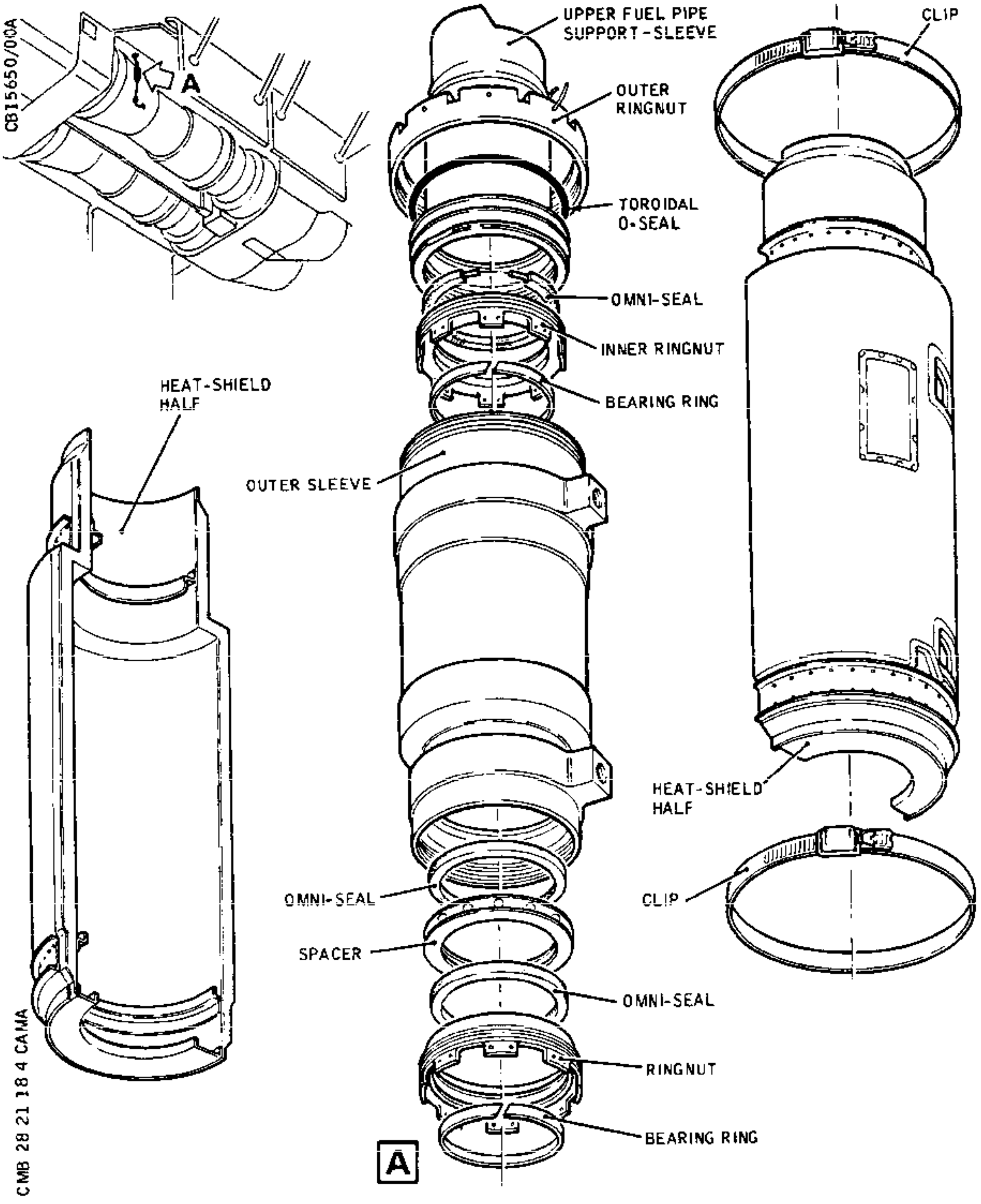
(5) Move the outer sleeve down the lower fuel pipe until the piston seal assembly is exposed.

CAUTION: EXTREME CARE MUST BE TAKEN TO ENSURE THAT THE WORKING SURFACE ON THE LOWER PIPE INNER SLEEVE IS NOT DAMAGED.

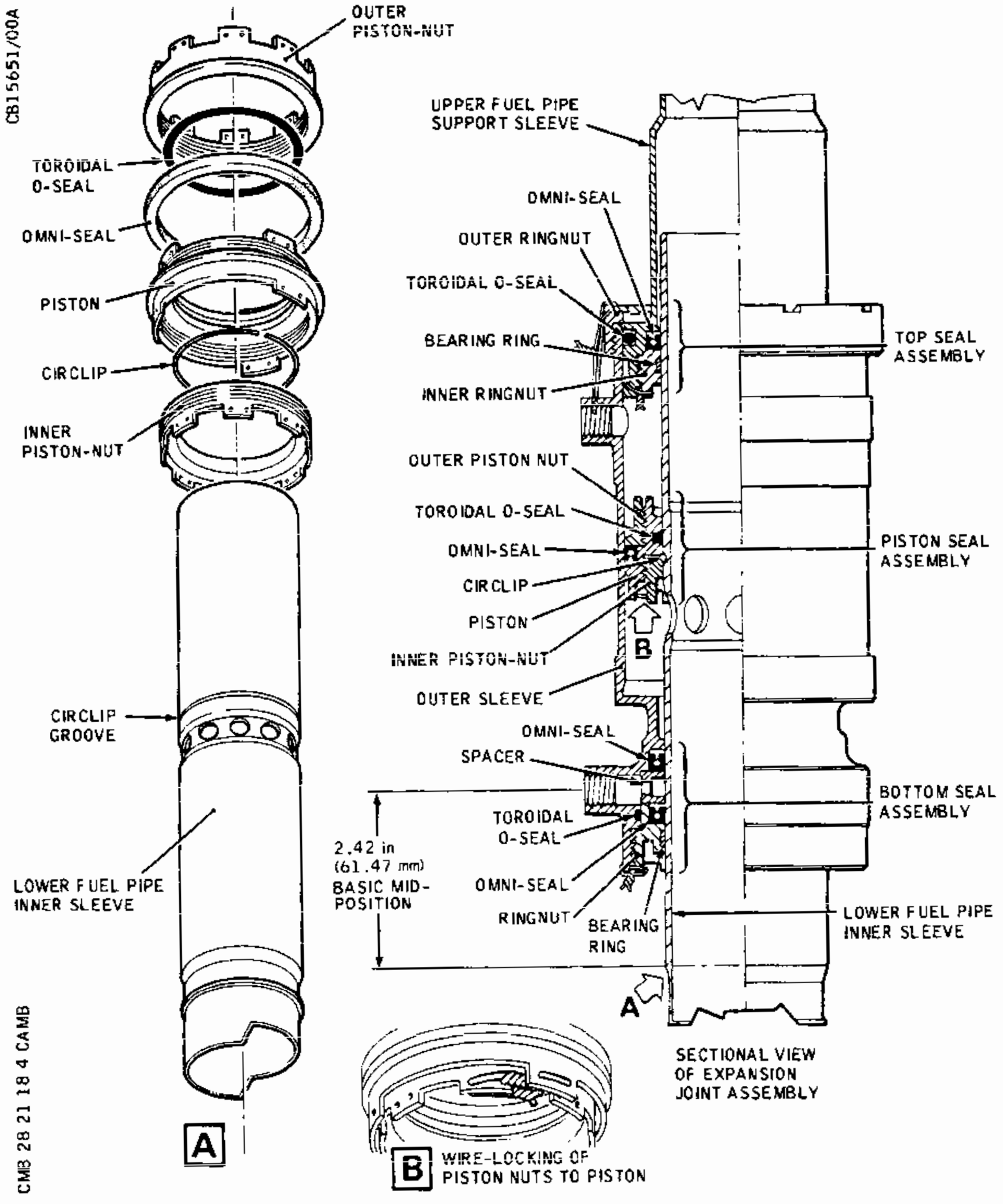
(6) At the piston seal assembly:-

(a) Remove the locking wire; restrain the piston and unscrew the inner and outer piston nuts.

(b) Remove the piston and outer piston nut from the



\- Expansion Coupling Seal Renewal (Sheet 1 of 2)
Figure 403



- Expansion Coupling Seal Renewal (Sheet 2 of 2)
Figure 403

lower pipe inner sleeve.

(c) Remove the circlip and the inner piston nut.

(d) Remove and discard the toroidal O-seal and omni-seal.

(7) Slide the outer sleeve, complete with bottom seal assembly, off the lower pipe inner sleeve. Suitably protect the inner sleeve.

(8) At the bottom seal assembly:-

(a) Remove the locking wire and unscrew the ringnut. Remove the ringnut complete with bearing ring and omni-seal. Discard the omni-seal.

(b) Remove the toroidal O-seal, spacer and omni-seal from the outer sleeve. Discard the seals.

(c) With the bearing ring in the ringnut, check that the ring gap width is between 0.13 and 0.17 in (3.30 and 4.31 mm). If necessary renew the bearing ring and ensure that the ring gap width is 0.15(±0.20) in (3.8(±0.50) mm).

(d) Suitably protect the outer sleeve and bottom seal parts.

(9) At the top seal assembly:-

(a) Remove the protection, remove the locking wire and unscrew the inner ringnut. Remove the inner ringnut complete with bearing ring.

(b) Remove the omni-seal and toroidal O-seal. Discard the seals.

(c) With the bearing ring in the ringnut, check that the ring gap width is between 0.13 and 0.17 in (3.30 and 4.31 mm). If necessary renew the bearing ring and ensure that the ring gap width is 0.15(±0.020) in (3.8 (±0.50) mm).

(d) Suitably protect the upper pipe support sleeve and top seal parts.

(10) Remove the protection from the lower pipe inner sleeve. Lubricate the inner sleeve bearing surface with petroleum jelly.

CAUTION: EXTREME CARE MUST BE TAKEN TO ENSURE THAT THE WORKING SURFACE ON THE LOWER PIPE INNER SLEEVE IS NOT DAMAGED.

OMNI-SEALS MUST BE POSITIONED SO THAT THE OPEN END FACES TOWARD THE FUEL PRESSURE (Ref. Fig. 403) (SHEET 2).

PROGRESSIVE DUPLICATE INSPECTION SHOULD BE CARRIED OUT DURING THE FITTING OF SEALS.

(11) Assemble the bottom seal assembly as follows:-

(a) Remove the protection from the outer sleeve and bottom seal parts.

(b) Slide the ringnut, complete with bearing ring, onto the inner sleeve.

(c) Fit a new omni-seal into the ringnut.

(d) Slide the spacer onto the inner sleeve.

(e) Position a new omni-seal in the recess of the outer sleeve near the drain boss.

(f) Fit a new toroidal O-seal in the groove of the outer sleeve near the drain boss.

(g) Carefully slide the outer sleeve over the inner sleeve and screw the ringnut into the outer sleeve, hand-tight only.

(12) Move the outer sleeve down the lower pipe inner sleeve until the circlip groove is exposed.

(13) Assemble the piston seal assembly as follows:-

(a) Slide the inner piston nut down the inner sleeve past the circlip groove.

(b) Partly open the circlip and slide it down the inner sleeve into the circlip groove.

(c) Fit a new toroidal O-seal in the inner groove of the piston and a new omni-seal on the outer land of the piston.

(d) Fit the outer piston nut to the piston. Using
R the ring spanner and torque spanner as required, torque-tighten the piston nut to between 80 and

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100 lbf in (0.904 and 1.130 mdaN) more than the nominal thread-friction-resistance torque.

(e) Slide the piston down the inner sleeve until it contacts the circlip. Fit the inner piston nut to the piston. Using the ring spanner and
R torque spanner as required, torque-tighten the inner piston nut to between 80 and 90 lbf in (0.904 and 1.017 mdaN) more than the nominal thread-friction-resistance torque.

(f) Wire-lock the piston nuts to the piston. Ensure that the cut end of the wire lies circumferentially within the castellations of the inner piston nut; and, for the outer piston nut, within the castellations of the piston (Ref. Fig. 403) (Sheet 2, Detail A).

(g) Fit suitable temporary protection to the lower fuel pipe.

(14) Assemble the top seal assembly as follows:-

(a) Remove the protection.

(b) Fit a new toroidal O-seal to the outer groove in the upper fuel pipe support sleeve.

(c) Fit a new omni-seal into the recess in the support sleeve.

(d) Fit the inner ringnut, complete with bearing ring, into the support sleeve. Using the strap
R wrench and torque spanner as required, torque-tighten the inner ringnut to between 80 and 100 lbf in (0.904 and 1.130 mdaN) more than the nominal thread-friction-resistance torque.

(e) Wire-lock the inner ringnut to the support sleeve. Ensure that the cut end of the wire lies around the outside of the castellations of the ringnut.

(15) Remove the protection from the lower fuel pipe.

(16) Assemble the expansion coupling as follows:-

(a) Gently insert the lower fuel pipe inner sleeve approximately 2 in (51 mm) into the upper fuel pipe support sleeve.

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(b) Maintain the lower fuel pipe in this position and gently slide the outer sleeve over the piston seal assembly and onto the top seal assembly.

(c) Fit the top seal assembly outer ringnut onto the outer sleeve. Using the strap wrench and torque
R spanner, torque-tighten the ringnut to between 100 and 120 lbf in (1.130 and 1.356 mdaN) more than the nominal thread-friction-resistance torque.

(d) Wire-lock the outer ringnut to the drain boss.

R (e) Using the strap wrench and torque spanner, torque-tighten the bottom seal assembly ringnut to between 100 and 120 lbf in (1.130 and 1.356 mdaN) more than the nominal thread-friction-resistance torque.

(f) Wire-lock the bottom seal assembly ringnut to the outer sleeve. Ensure that the cut end of the locking wire lies around the outer sleeve.

(g) Set the coupling to the basic mid-position (Ref. Fig. 403) (Sheet 2).

(17) Using the push-pull gauge, check that the load required, to compress and extend the coupling 1 in (25.4 mm), in each direction, does not exceed 100 lbf (445 N).

(18) 'Close-up' the coupling by pushing up on the lower fuel pipe until the piston seal assembly contacts the top seal assembly.

(19) Using the syringe, prime the drain bosses with clean fuel.

<u>NOTE:</u> Filling the voids in the outer sleeve with fuel will assist leak detection.

(20) Check the expansion coupling for freedom from leaks (Ref. Adjustment/Test - Leakage Test, Using Fuel Pressure Test Rigs). During the 15 min test, slowly partially rotate the lower half of the fuel pipe.

<u>NOTE:</u> If the pipe extends during the pressure test, re-prime the top drain boss with fuel.

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(21) After the leakage test, use the syringe to suck out as much fuel as is possible from the drain bosses.

(22) Using the clean dry air supply, direct air across (not into) the drain bosses for 10 min.

NOTE: This will assist in drying out residual fuel in the coupling voids.

(23) Fit the heat shield to the expansion coupling and secure it with the clips. Ensure that the clip screws will not foul any part of the installation. Using the torque screwdriver, torque-tighten the clips to between 14 and 18 lbf in (0.158 and 0.203 mdaN). Wire-lock the clip screws in accordance with 20-21-13.

D. Conclusion

(1) Connect the drain pipes, and connect the fuel pipe to the engine inlet (Ref. para.2. or 3.).

ENGINE INLET FUEL PIPE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises two different leakage test procedures. These are provided to complement either a 'removal/ installation' or 'seal renewal' of the inlet fuel pipe expansion coupling. Operational, Functional and System Tests do not apply in this instance.

The procedure in paragraph 2. uses the engine feed pumps to pressurize the pipe. As some of the pipe connections to the dry bay bulkhead connector are shrouded by heat shields, or hidden (with engine installed), this test will be called for before the heat shields and anti-vibration sleeves are installed (Ref. Removal/Installation).

The procedure in paragraph 3. uses fuel test rigs, a feed pipe test blank and a union adapter to pressurize the pipe to a higher pressure than can be achieved using the engine feed pumps. This test procedure must be used after seal replacement at the expansion coupling of the inlet fuel pipe (Ref. Removal/Installation).

2. Leakage Test - Using Engine Feed Pumps

A. Prepare - Using Engine Feed Pumps

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Ensure that the associated circuit breakers are set.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 1 LP VALVE SUP 2	16-215	1Q2	-

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
ENG 4 LP VALVE SUP 2	16-215	4Q2	-

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that the collector tank, for the pipe(s) under test, contains at least 1,000 kg of fuel. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing) as required.

(5) Ensure that the associated LP VALVE switch is set to OPEN, with its indicator displaying bar-in-line.

B. Test - Using Engine Feed Pumps

NOTE: If the inlet fuel pipe is connected to the engine inlet, it will not be necessary to bleed air from the engine feed system. The engine recirculation valve is normally open when the HP VALVE switch is at SHUT. Therefore, fuel will recirculate to the collector tank via the engine recirculation valve and recirculation pressure holding valve.

On engine 2 or 4, if a test blank is fitted to the inlet fuel pipe, air must be bled from the system (Ref. Removal/Installation, para.3.D.).

(1) Set the associated ENGINE FEED PUMPS switches to "ON". Ensure that the LOW PRESS captions are extinguished.

(2) Allow the pumps to run for at least 15 min. During this period, check all disturbed piping and component connections for freedom from leakage. There is no

permissible leakage.

C. Conclusion

(1) Set the ENGINE FEED PUMPS switches to "OFF".

(2) If required, set the associated LP VALVE switch to "SHUT 1". Ensure that the indicator display changes to bar-across-line.

(3) If required, trip the associated circuit breaker (Ref. para.A.(2)).

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(5) As required, complete the removal/installation procedures.

3. Leakage Test - Using Fuel Pressure Test Rigs

A. Equipment and Materials

DESCRIPTION	PART NO.
Test blank for engine feed pipe	E925123000
Fuel pressure test rig (qty. 2)	-
Petroleum jelly (Ref. 20-30-00, No.27)	-
Union adapter (3/8-24 UNF), for use at banjo bolt bosses	-
Washer, for use with union adapter	-

B. Prepare - Using Fuel Pressure Test Rigs

NOTE: The LP valve must be shut, with its associated circuit breaker tripped (Ref. Removal/Installation).

(1) Fit new O-seals, lubricated with petroleum jelly, to the flanged end of the inlet fuel pipe.

(2) Fit the engine feed pipe test blank to the inlet fuel pipe and secure it with the clamp.

(3) Connect a fuel pressure test rig to the blank.

C. Test - Using Fuel Pressure Test Rigs

(1) Prime the pipe with fuel, by pumping at least 20 gal (Imp.) (91 l) through the inlet fuel pipe.

<u>NOTE</u>: Fuel will flow back to the associated collector tank via the recirculation LP control valve and recirculation pressure holding valve.

(2) Push up on the bottom half of the inlet fuel pipe and 'close-up' the expansion joint.

(3) Remove the recirculation pressure holding valve element (Ref. 28-21-16, Removal/Installation).

(4) Using the test rig, pressurize the pipe to 75 psig (5.175 bar) for not less than 15 min. During this period, check that there is no leakage of fuel from the expansion joint and banjo bolt bosses.

<u>NOTE:</u> As the test pressure builds-up the inlet fuel pipe may extend downward approximately 2 in (51 mm).

(5) Reduce the test pressure to 50 psig (3.45 bar). Maintain this pressure.

(6) Connect the second test rig to the expansion coupling lower banjo bolt boss with the washer and union adapter.

(7) Using the second test rig, apply a pressure of 20 psig (1.380 bar) for a period of not less than 10 min. During this period, check that there is no leakage past the lower seals.

(8) Release the test pressure at the second test rig and remove the test connector from the lower banjo bolt boss. Make provision to collect fuel draining from the lower boss.

(9) Connect the second test rig to the expansion coupling upper banjo bolt boss.

(10) Using the second test rig, apply a pressure of 20 psig (1.38 bar) for a period of not less than 10 min. During this period, check that there is

no leakage from the upper seals.

(11) Release the test pressure from both test rigs. Make provision to collect fuel draining from the inlet fuel pipe and disconnect the test rigs.

D. Conclusion

(1) Fit suitable blanks to the banjo bolt bosses and refit the blank removed from the test blank.

(2) Fit the recirculation pressure holding valve element (Ref. 28-21-16, Removal/Installation).

(3) As required, complete the installation procedures.

BY-PASS VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The by-pass valve, in each of the four engine feed systems, is located in the wing dry bay above the nacelle. Each valve is secured to the associated recirculation control valve and has rigid-pipe and electrical connections. Because of pipe restrictions, the two valves must be removed as an assembly and separated on the bench. The engine feed pipe must be drained of fuel prior to valve removal.

The by-pass valve gearbox and motor assembly may be removed independently from the valve and prior drainage of the engine feed pipe is not required.

During renewal of either the gearbox and motor or the complete by-pass valve assembly, the motor gearbox must be primed with clean fuel prior to installation in the aircraft.

2. By-pass Valve Gearbox and Motor (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Key, for access panel	E920132000
Circuit breaker safety clips	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
R Grease, anti-fretting (Ref. 20-30-00, No.54)	Aeroshell 17

B. Prepare

(1) Ensure that the motor is in the closed position, i.e., the HYD/COND FUEL EXCH BY-PASS valve switch on the fuel management panel set to OFF.

(2) Electrically isolate the by-pass valve by tripping the associated circuit breaker; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
ENG 3 BY-PASS VALVE SUP & IND	15-215	3Q762	F25
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6

(3) Using the key, unlock and remove the appropriate access panel on the wing upper surface to gain access to the by-pass valve.

(4) If necessary, remove the extinguisher bottles (Ref. 26-21-11, Removal/Installation).

C. Remove

(1) Disconnect the electrical connector from the motor.

(2) Remove the four bolts securing the gearbox and motor assembly, and withdraw it from the valve body.

D. Install

B NOTE 1: Valve P/N 942021 (Long Actuator) cannot be fitted at No.1 location on A/C G-BOAB and G-BOAC due to the Proximity of Hydraulic Pipes at this location. Install valve P/N 9402018.

B 2: If a gearbox and motor assembly for engines 3 and 4 is being installed, because the installation is 'handed' the cover plate must be fitted to the end of the gearbox housing opposite to the end-plate.

B New O-ring seals, lubricated in accordance with 20-23-11, must be fitted at each end of the

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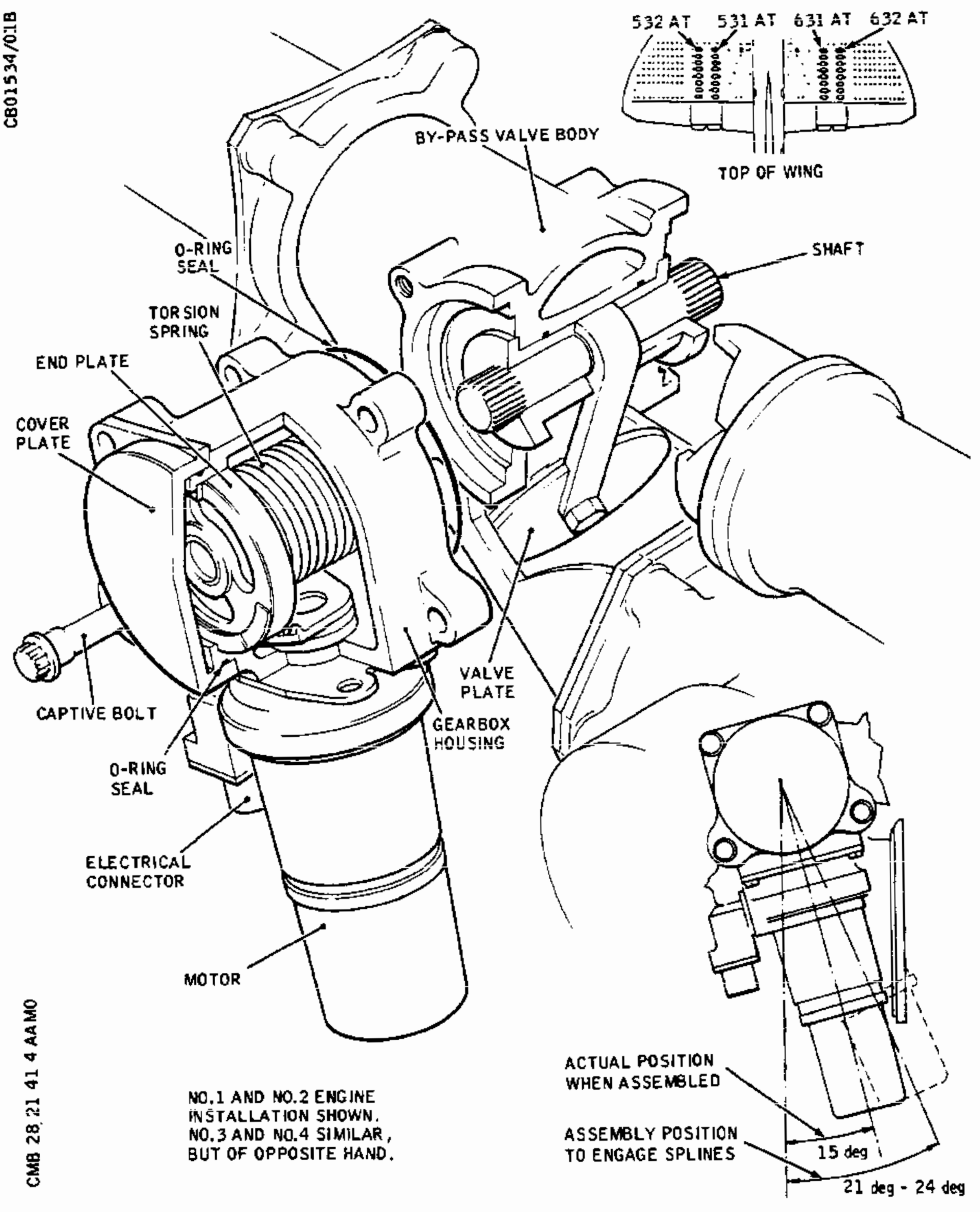

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- By-pass Valve, Gearbox and Motor - Installation
Figure 401

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B gearbox housing.

(1) Comply with the fuel and electrical safety precautions.

(2) Ensure that the valve shaft turns freely.

(3) Prime the gearbox with clean fuel, as follows:-

(a) For engines 1 and 2:-

a1) Unscrew the captive bolts and remove the cover plate.

a2) Fit a new O-ring seal, lubricated in accordance with 20-23-11.

(b) For engines 3 and 4:-

b1) Unscrew the captive bolts and remove the cover plate.

b2) Fit new O-ring seals, lubricated in accordance with 20-23-11.

b3) Fit the cover plate to the end of the gearbox housing opposite to the end-plate.

(c) With the gearbox held end-plate upward, pour clean fuel via the holes in the end-plate into the gearbox. During this operation, gently tilt and oscillate the gearbox; this will prevent airlocks and ensure complete filling.

(d) For engines 1 and 2, refit the cover plate to the end-plate end of the gearbox housing.

(4) Apply anti-fretting grease to the splines on the valve shaft.

(5) With the valve plate and the gearbox and motor in the closed positions, fit the gearbox to the valve body (Ref. Fig. 401) so that the splined gearbox drive shaft engages the valve shaft and the gearbox engages the valve body.

(6) Turn the gearbox so that the bolt holes are aligned and the torsion-spring is tensioned to hold the valve plate in the closed position. Secure the gearbox with the four captive bolts; torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(7) Connect the electrical connector to the motor, ensuring that the mating surfaces are clean and undamaged.

(8) Remove the safety clip and reset the circuit breaker previously tripped.

(9) Ensure that the LP protection HYD/COND FUEL EXCH BY-PASS switch is at OFF.

(10) Switch on the associated engine feed pumps (Ref. 28-21-00).

(11) Motor the by-pass valve open and shut four times at a rate not exceeding four cycles per minute, as follows:-

NOTE: During these operations, the associated equipment must be checked for freedom from fuel leaks.

(a) Connect an independent 28 V d.c. supply to the coil of the associated control relay via its test module terminal (Ref. Table 401).

ENGINE	RELAY BOX	TEST MODULE TERMINAL
1	15-123	UT 1851-10C
2	15-123	UT 1851-11A
3	18-123	UT 1852-3C
4	18-123	UT 1852-3A

Test Module Location
Table 401

NOTE: With 28 V d.c. at the test module terminal, the valve will motor open. With 28 V d.c. disconnected from the test module terminal, the valve will motor shut.

(b) Check that the time taken for the valve to open or shut is between 1 and 2 s.

(c) Disconnect the independent 28 V d.c. supply.

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(12) Switch off the engine feed pumps.

NOTE: Because the installation procedures include checks for leaks and satisfactory operation of the valve motor via its control relay, further checks are not required.

E. Conclusion

(1) If applicable, refit the extinguisher bottles (Ref. 26-21-11, Removal/Installation).

(2) Refit the access panel and lock it, using the key.

3. Motor (Ref. Fig. 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Test lever (Flight Refuelling)	2249005

B. Prepare

(1) Remove the by-pass valve gearbox and motor (Ref. paras.2.A., B. and C.).

C. Remove

(1) Slacken the nuts securing the motor unit to the gearbox.

(2) Fit the test lever to the splined drive of the gearbox.

(3) For engines 1 and 2 installation, rotate the test lever 12 to 15 deg clockwise. For engines 3 and 4 installation, rotate the test lever 12 to 15 deg counter-clockwise.

NOTE: This will increase spring tension in the gearbox and facilitate the removal of the motor from the gearbox.

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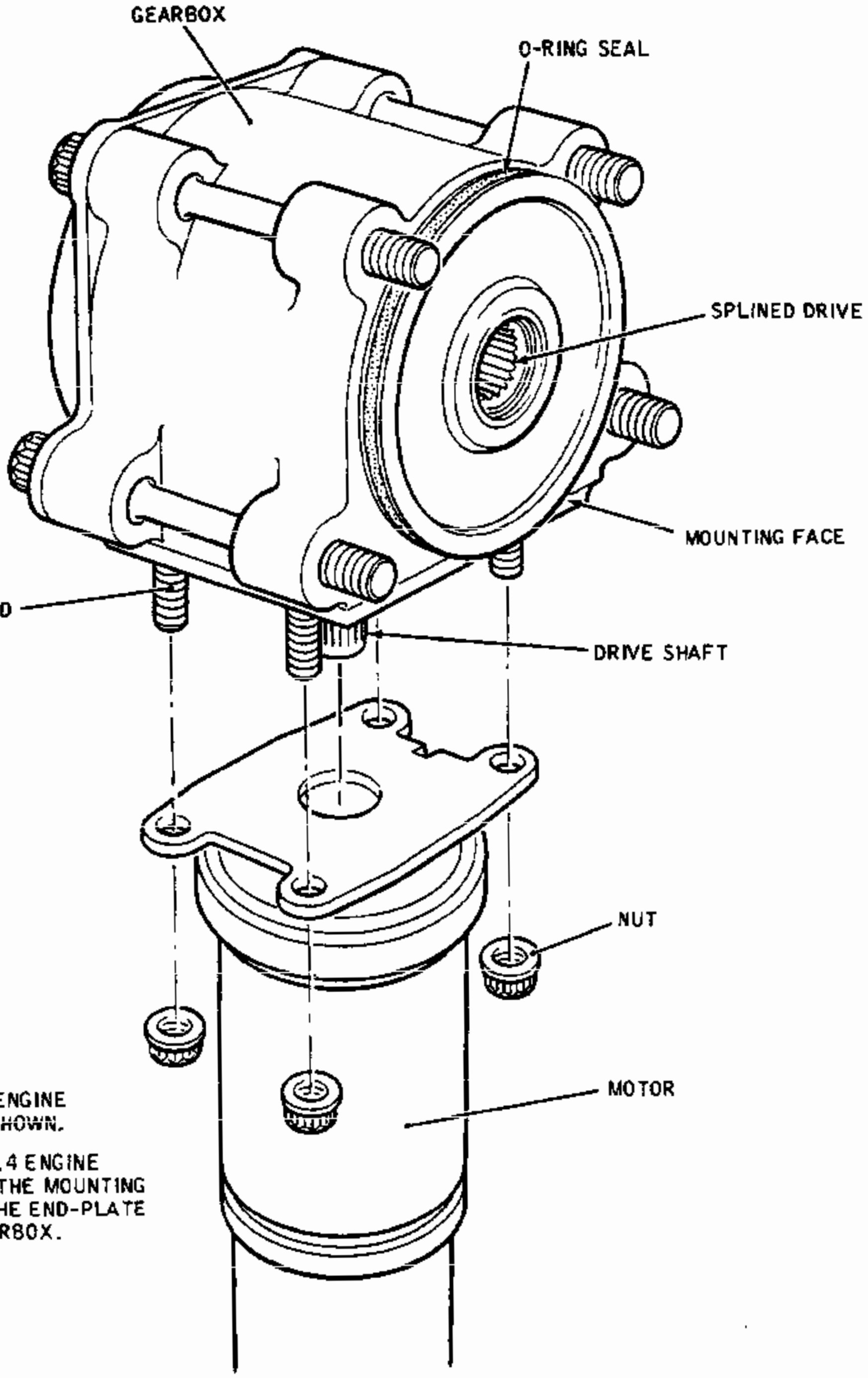

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Motor - Installation
Figure 402

(4) Remove the nuts securing the motor to the gearbox and carefully ease the gearbox from the motor unit.

(5) Remove the test lever from the gearbox.

D. Install

(1) Secure the test lever in a vice. Carefully position the gearbox splined drive onto the test lever.

(2) For engines 1 and 2 installation, rotate the gearbox 12 to 15 deg clockwise. For engines 3 and 4 installation, rotate the gearbox 12 to 15 deg counter-clockwise.

NOTE: This will increase spring tension in the gearbox and facilitate the assembly of the motor to the gearbox.

(3) With spring tension maintained, fit the motor to the gearbox. During this operation, align the motor and gearbox drive shafts as required.

(4) Fit the nuts to the gearbox studs and torque-tighten the nuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(5) Remove the gearbox from the test lever.

E. Conclusion

(1) Prime the gearbox with fuel and install the gearbox and motor assembly (Ref. para.2.D.).

4. By-pass Valve (Ref. Fig. 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Drain equipment, for engine feed pipeline	D925377000
Key, for wing access panel	E920132000
Circuit breaker safety clips	-
Locking wire, non-corrodible steel, 0.028 in (0.7 mm) dia.	-

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 80 to 89 lbf in (0.904 to 1.006 mdaN)	-

B. Prepare

(1) Isolate the by-pass valve from the collector tank fuel supply by closing the system low-pressure fuel isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) On the fuel management panel set the LP VALVE switch for the associated engine feed system to "SHUT 1".

(c) Attach a placard to the fuel management panel to indicate that the fuel system is disassembled, and that no fuel management switch is to be operated.

(2) Electrically isolate the by-pass valve and the recirculation valve temperature probes by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine 1			
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24
FUEL TEMP IND	15-215	D1	B25
GRP 1 FUEL VALVE CONT	2-213	1H863	D16

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRP 1 TEMP SELECTOR AUTO SUP AND CONT	2-213	H1000	B17
Engine 2			
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
FUEL TEMP IND	15-215	D1	B25
GRP 2 FUEL VALVE CONT	4-213	2H863	E12
GRP 2 TEMP SELECTOR AUTO SUP AND CONT	4-213	H1001	E11
Engine 3			
ENG 3 BY-PASS VALVE SUP & IND	15-215	3Q762	F25
FUEL TEMP IND	15-215	D1	B25
GRP 3 TEMP SELECTOR AUTO SUP & CONT	2-213	H1002	G16
GRP 3 FUEL VALVE CONT	2-213	3H863	F16
Engine 4			
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6
FUEL TEMP IND	15-215	D1	B25
GRP 4 TEMP SELECTOR AUTO SUP & CONT	4-213	H1003	B12
GRP 4 FUEL VALVE CONT	4-213	4H863	B11

(3) Using the key, unlock and remove the appropriate access panel on the wing top surface to gain access to the by-pass valve and recirculation control valve (Ref. Fig. 401).

(4) Drain the fuel from the engine feed pipeline (Ref. 28-21-00, Servicing).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(6) Remove the extinguisher bottles (Ref. 26-21-11, Removal/Installation).

C. Remove

(1) Disconnect the electrical connectors from the by-pass valve motor and the two temperature probes on the recirculation control valve.

(2) Disconnect the by-pass valve from the engine feed pipe by removing the bolts securing the bolted flange and bonding lead. Slide the bolted flange and the circlip clear of the joint.

(3) To assist the disconnection of the recirculation pipeline collector block, remove sufficient pipe support clips from the associated small bore pipes. During removal note the positions of the clips. Retain the clips with their bolts, washers and, where applicable, the bonding strips.

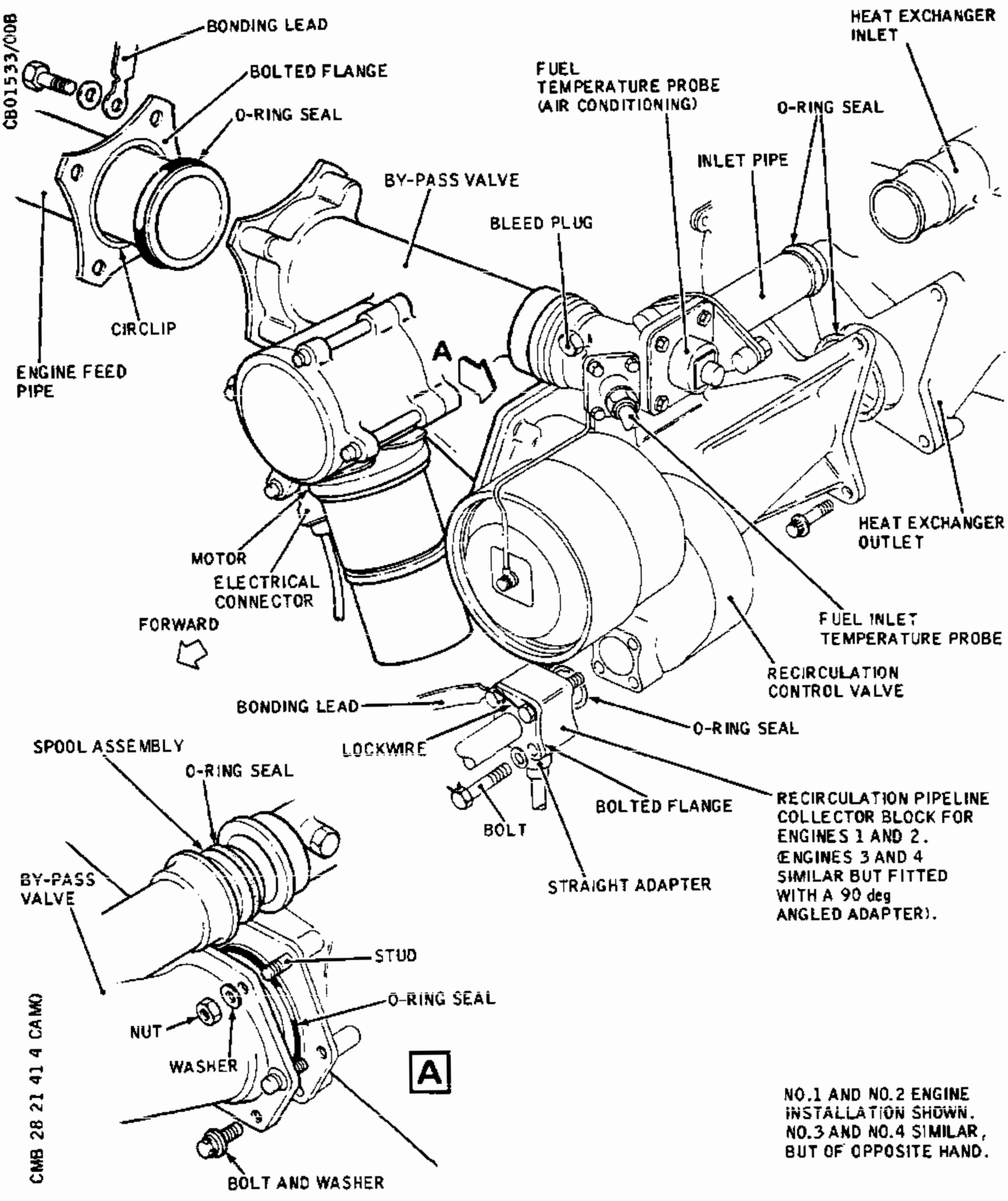
(4) Remove the four bolts and washers securing the recirculation pipeline collector block to the recirculation control valve.

(5) Support the valves and remove the four bolts and washers securing the recirculation valve to the heat exchanger.

(6) Withdraw the recirculation control valve and the by-pass valve from the heat exchanger and the engine feed pipe respectively. Remove the two valves through the access panel aperture.

(7) Fit suitable blanks to the open pipelines and components.

(8) Disassemble the by-pass valve from the recirculation control valve by removing the four bolts and two nuts securing the by-pass valve outlet duct flange,



NO.1 AND NO.2 ENGINE INSTALLATION SHOWN. NO.3 AND NO.4 SIMILAR, BUT OF OPPOSITE HAND.

\- By-pass Valve - Installation
Figure 403

and withdraw the by-pass valve from the control valve.

(9) Fit suitable blanks to both valves.

D. Install

CAUTION: THE BY-PASS VALVE GEARBOX MUST BE PRIMED WITH FUEL BEFORE ASSEMBLY TO THE AIRCRAFT.

NOTE: All O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the four bolts securing the gearbox and motor, and withdraw it from the valve body.

(2) Prime the gearbox with clean fuel as follows:-

(a) For engines 1 and 2:-

a1) Unscrew the captive bolts and remove the cover plate.

a2) Fit a new O-ring seal, lubricated in accordance with 20-23-11.

(b) With the gearbox held end-plate upward, pour clean fuel via the holes in the end-plate into the gearbox. During this operation, gently tilt and oscillate the gearbox; this will prevent airlocks and ensure complete filling.

(c) For engines 1 and 2, refit the cover plate to the end-plate end of the gearbox housing.

(3) Apply anti-fretting grease to the splines on the valve shaft.

(4) With the valve plate and the gearbox and motor in the closed positions, fit the gearbox to the valve body (Ref. Fig. 401) so that the splined gearbox drive shaft engages the valve shaft and the gearbox engages the valve body.

(5) Turn the gearbox so that the bolt holes are aligned and the torsion-spring is tensioned to hold the valve plate in the closed position. Secure the gearbox with the four captive bolts; torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Ensure that the fuel and electrical safety precautions are complied with.

(7) Assemble the by-pass valve to the recirculation control valve as follows:-

(a) Remove the blanks from the spool assembly and by-pass valve, and from the associated ports of the recirculation control valve.

(b) Fit new O-ring seals to the spool assembly and the large diameter mating port of the recirculation control valve (Ref. Fig. 403) (Detail A).

(c) Insert the spool assembly into the control valve and locate the by-pass valve flange on the two studs; secure the flange with the washers, two nuts and four bolts. Torque-tighten each nut and bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(8) Install the combined recirculation control valve and by-pass valve as follows:-

(a) Remove the remainder of the blanks fitted to the piping and associated components.

(b) Fit new O-ring seals to the engine feed pipe, the inlet-pipe to heat-exchanger and the recirculation-control-valve to heat-exchanger-outlet port.

(c) Support the valves in position, inserting the engine feed pipe into the by-pass valve and the inlet pipe on the control valve into the heat exchanger.

(d) Secure the control valve to the heat exchanger; torque-tighten each bolt to between 80 and 89 lbf in (0.904 and 1.006 mdaN).

(e) Secure the by-pass valve to the engine feed pipe, ensuring that the bonding lead is secured beneath the bolt with the dimpled head; torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(f) Renew the O-ring seal on the recirculation pipeline collector block and refit the block to the control valve; ensure that the bonding

lead is secured beneath one of the bolt heads; torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN). Lock the bolts with wire in accordance with 20-21-13.

(9) Ensure that the installation of the engine feed pipe, spool assembly and inlet pipe comply with the requirements of 20-23-21.

(10) Refit in the positions noted during removal, the pipe support clips on the small-bore piping associated with the recirculation pipeline collector block. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(11) Where applicable, check the bonding of the pipe to clip and structure, and components to structure in accordance with 20-27-11.

(12) Connect the electrical connectors to the by-pass valve and the two temperature probes, ensuring that the mating surfaces are clean and undamaged.

(13) Remove the placard from the fuel management panel.

(14) Reset the circuit breakers previously tripped.

(15) Make available electrical ground power as detailed in 24-41-00.

(16) Set the LP VALVE switch to "OPEN" and secure it in this position with the switch guard.

(17) Ensure that the LP protection HYD/COND FUEL EXCH BY-PASS switch is at OFF.

(18) Switch on the associated engine feed pumps (Ref. 28-21-00).

(19) Motor the by-pass valve open and shut four times at a rate not exceeding four cycles per min as follows:-

NOTE: During these operations, the associated equipment must be checked for freedom from fuel leaks.

(a) Connect an independent 28 V d.c. supply to the coil of the associated control relay via its test module terminal (Ref. Table 402).

ENGINE	RELAY BOX	TEST MODULE TERMINAL
1	15-123	UT 1851-10C
2	15-123	UT 1851-11A
3	18-123	UT 1852-3C
4	18-123	UT 1852-3A

Test Module Location
Table 402

NOTE: With 28 V d.c. at the test module terminal the valve will motor open. With 28 V d.c. disconnected from the test module terminal, the valve will motor shut.

(b) Check that the time taken for the valve to open or shut is between 1 and 2 s.

(c) Disconnect the independent 28 V d.c. supply.

(20) Switch off the engine feed pumps.

NOTE: Because the installation procedures include checks for leaks and satisfactory operation of the valve motor via its control relay, further checks are not required.

E. Conclusion

(1) Carry out a Functional Test of the recirculation control valve (Ref. 28-21-44, Adjustment/Test).

(2) Carry out an Operational Test of the fuel inlet temperature probe (Ref. 28-45-00, Adjustment/Test).

(3) Carry out a Functional Test of the air conditioning fuel temperature probe (Ref. 21-13-32).

(4) Refit the extinguisher bottles (Ref. 26-21-11).

(5) Refit the access panel and lock it, using the key.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

BYPASS VALVE - ADJUSTMENT/TEST

1. General

Four bypass valves, one for each engine feed system, are normally controlled by fuel pressure from the engine feed pumps. Under 'negative G' conditions, a fuel underpressure signal from the accumulator indication circuit energizes the valve motor to open the valve.

The valve position indicators and the bypass valve arming switch are located on the fuel management panel.

This topic comprises a Functional Test of the valve. Operational and System Tests are not applicable.

A Leakage Test of the valve and pipe connections is described in the engine feed and recirculation pipe leakage test (Ref. 28-21-00, Adjustment/Test).

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Air supply rig, capable of supplying a pressure of 100 psig (6.895 bar)	-
Minilock coupling, at the air supply hose-end	SAREM 711AB

B. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the collector tank, associated with the bypass valve under test, contains at least 1,000 kg of fuel.

(4) Open the appropriate (No.1 or No.3) engine bay rear

door to the servicing position (Ref. 71-00-00, Servicing) to gain access to the fuel/hydraulic ground air charging (self-sealing) Minilock coupling (Ref. 28-21-00, Adjustment/Test, Fig.502).

(5) Remove the cap from the coupling and connect an air supply rig.

NOTE: Air pressure applied to the coupling in No.1 engine bay will pressurize the hydraulic reservoirs and tanks 1 and 2 accumulators. The coupling in No.3 engine bay is used to pressurize the hydraulic reservoirs and tanks 3 and 4 accumulators.

(6) Ensure that it is safe to pressurize the hydraulic reservoir charging system (Ref. 29-13-00, Servicing).

(7) At the fuel management panel, check that the ACC captions are illuminated.

(8) Check that the associated LP VALVE switch is set to OPEN and the magnetic indicator displays bar-in-line.

C. Test

(1) Set the associated control switch for either the 1st or the 2nd standby ENGINE FEED PUMPS to "ON"; check that the pump LOW PRESSURE caption is extinguished as pump pressure builds up.

(2) Check that the ACC captions remain illuminated, indicating no accumulator air pressure.

NOTE: Since there is no fuel demand from the engine, the recirculation control valve will permit fuel to flow back to the collector tank.

(3) Operate the air supply rig and pressurize the accumulator air line to 80 psig (5.516 bar) and check that the appropriate ACC caption is extinguished.

(4) Set the FUEL LP PROTECTION bypass valve arming switch to "ARMED".

(5) Set the standby ENGINE FEED PUMPS switch to "OFF".

(6) Check that -

(a) the ACC caption is illuminated and

(b) the assocated FUEL LP PROTECTION magnetic indicator displays OPEN, indicating the operation of the bypass valve.

(7) After 30 s, set the appropriate standby ENGINE FEED PUMPS switch to "ON" and check that the ACC caption is extinguished 2 to 3 s later, and the FUEL LP PROTECTION magnetic indicator display changes to black.

(8) Set the FUEL LP PROTECTION bypass valve arming switch to "OFF".

(9) Set the standby ENGINE FEED PUMPS switch to "OFF".

D. Conclusion

(1) Release the air pressure at the supply rig; disconnect the air supply line and refit the cap to the self-sealing coupling in the engine bay.

(2) Close the engine bay door (Ref. 71-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

E. <u>Alternative Function Test - to be carried out during engine run</u>

(1) With engines running at idle power:
Set LP PROTECTION switch to ....ARMED

(2) For each system in turn:

Check ACC light	..........OFF
Switch ENGINE FEED PUMPS	..........OFF
Check ACC light	..........ON
Check LOW PRESS LIGHT	..........OFF
Check HYD/COND FUEL EXCH. BY-PASS M.I	..........OPEN within 3 secs
Switch ENGINE FEED PUMPS	..........ON
Check ACC light	..........OFF
Check HYD COND FUEL EXCH. BY-PASS M.I	..........BLACK

NOTE: At idle power, the accumulator will supply fuel for approx. 20 secs. After this period the engine inlet LOW PRESS light may come on.

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DRAIN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Each fuel drain valve is fitted in the fuel feed pipeline where it passes through the bottom surface of the wing in the dry bay above the nacelle. The pipeline must be drained of fuel prior to removal of the valve.

2. Drain Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Drain equipment, for fuel feed pipeline	D925377000
Key, for wing access panel	E920132000
Torque spanner, 90 to 120 lbf in (1.017 to 1.356 mdaN)	-
Torque spanner, 175 to 185 lbf in (1.977 to 2.090 mdaN)	-
Circuit breaker safety clips	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the drain valve from its collector tank fuel supply by closing the LP isolation valve as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) Set the LP VALVE switch for the engine feed system to "SHUT 1".

R (3) Place at the panel a placard warning that the settings of the switches must not be altered.

R (4) Electrically isolate the LP isolation valve by tripping the appropriate circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 1 LP VALVE SUP 2	16-215	1Q2	-
ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
ENG 4 LP VALVE SUP 2	16-215	4Q2	-

R (5) Using the key, remove the appropriate access panel from the wing top surface, to gain access to the drain valve.

R (6) Cut the locking wire and unscrew the pressure cap from the drain valve.

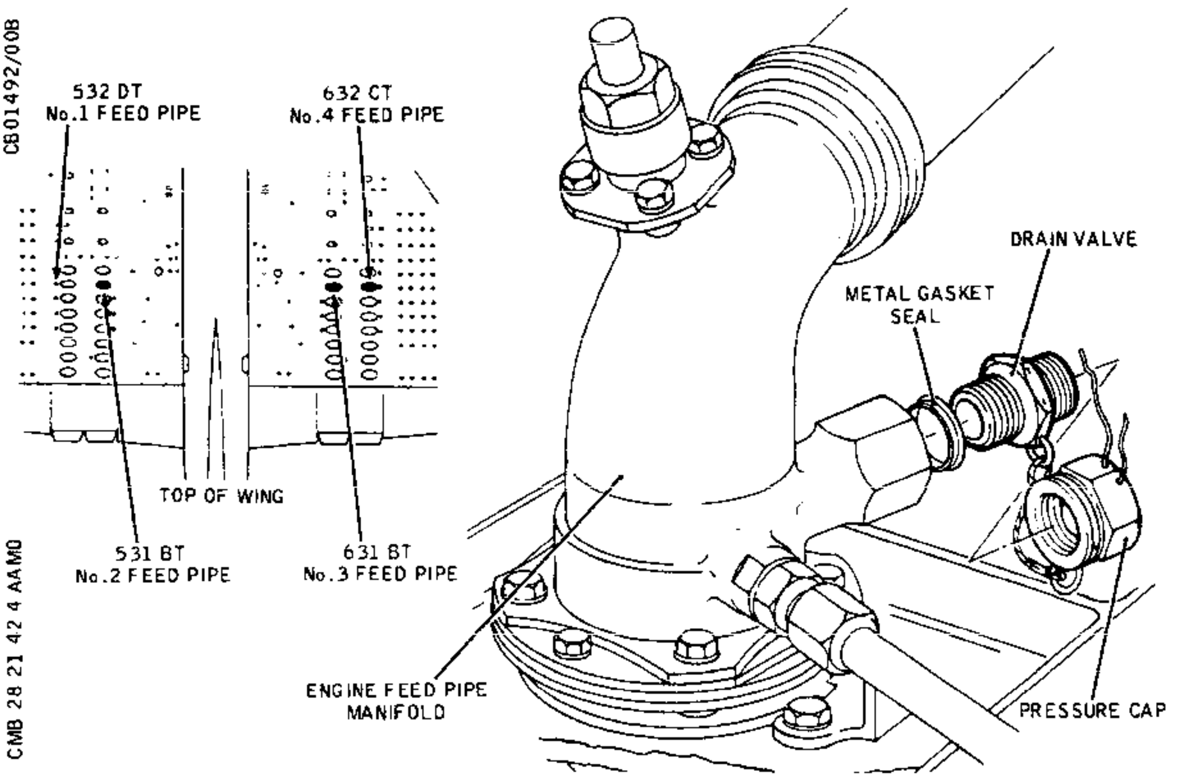
R (7) Drain the residual fuel from the engine feed pipeline, using the drain equipment as detailed in 28-21-00, Servicing.

R C. Remove

R (1) Unscrew the drain valve from the fuel pipe manifold. Discard the metal gasket seal and fit suitable blanks to the valve and manifold apertures.

R D. Install

(1) Remove the blanks from the valve and manifold apertures and fit the valve, together with a new



R - Drain Valve - Installation (Typical)
Figure 401

gasket seal, to the manifold, ensuring that the seal is correctly fitted. Torque-tighten the valve to between 175 and 185 lbf in (1.977 and 2.090 mdaN).

(2) Reset the circuit breakers previously tripped.

(3) Set the LP VALVE switch to "OPEN".

(4) Check the valve for leakage, as follows:-

(a) Ensure, by reference to the tank fuel quantity indicator, that the associated collector tank contains a minimum of 1,000 kg of fuel.

(b) On the fuel management panel, set any one of the three associated ENGINE FEED PUMP switches to "ON"; check that its LOW PRESS caption is extinguished as the pump reaches its operating pressure.

(c) Check that there is no leakage of fuel from the valve over a minimum period of 10 min.

R (5) Set the ENGINE FEED PUMP switch to "OFF".

R E. Conclusion

R (1) Switch off and disconnect electrical ground power as
R detailed in 24-41-00.

R (2) Wire-lock the pressure cap to the drain valve in
R accordance with 20-21-13.

R (3) Refit the access panel and lock it, using the key.

LP ISOLATION VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four LP isolation valves, one for each engine feed system. Removal and installation of a valve element complete with twin motors is effected from within the dry bay. Each element can be removed from its canister without the necessity for draining the engine feed pipeline in which it is fitted, as the canister ports are automatically sealed by a sleeve when the element is withdrawn. Each valve is mounted on a sidewall of the dry bay and removal of a canister is effected from the adjoining fuel tank on the opposite side of the sidewall and necessitates draining both the fuel tank and the engine feed pipeline.

This topic comprises the removal/installation procedures for a valve element and a valve canister.

2. Valve Element

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Container, 1 pint (0.57 l), for fuel drainage	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

B. Prepare to Remove Valve Element

(1) Remove the appropriate access panel (Ref. Fig.401).

(2) Electrically isolate the valve by tripping the associated circuit breakers for its supply and indication circuits. Fit safety clips. Also isolate the associated cross-feed valve by tripping the appropriate circuit breaker. Fit a safety clip.

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 LP VALVE SUP 1	15-216	1Q 1	C 1
ENG 1 LP VALVE SUP 2	16-215	1Q 2	-
ENG 1 LP VALVE POSN IND	15-215	1Q 3	C21
ENG 2 LP VALVE SUP 1	15-216	2Q 1	F 2
ENG 2 LP VALVE SUP 2	15-215	2Q 2	C19
ENG 2 LP VALVE POSN IND	15-216	2Q 3	C 3
ENG 3 LP VALVE SUP 1	15-216	3Q 1	F 1
ENG 3 LP VALVE SUP 2	15-215	3Q 2	C20
ENG 3 LP VALVE POSN IND	15-216	3Q 3	C 4
ENG 4 LP VALVE SUP 1	15-216	4Q 1	C 2
ENG 4 LP VALVE SUP 2	16-215	4Q 2	-
ENG 4 LP VALVE POSN IND	15-215	4Q 3	C22
ENG 1 CROSS-FEED VALVE SUP & IND	3-213	1Q 41	B 5
ENG 2 CROSS-FEED VALVE SUP & IND	1-213	2Q 41	K11
ENG 3 CROSS-FEED VALVE SUP & IND	1-213	3Q 41	K12
ENG 4 CROSS-FEED VALVE SUP & IND	3-213	4Q 41	B 6

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

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C. Remove Valve Element (Ref. Fig.401)

(1) Disconnect the three electrical connectors from the valve.

(2) Disconnect the valve bonding lead from the aircraft bracket.

(3) Slacken the drain plug.

CAUTION: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMPING NUT STUDS, DO NOT SLACKEN THE CLAMPING NUTS MORE THAN TWO TURNS.

(4) Slacken the clamp nuts by not more than two turns.

(5) Rotate the valve element clockwise through 90 deg and align the cut-outs in the valve body with the clamp nuts.

(6) Position the container under the drain plug and remove the drain plug. Allow fuel (approximately 1 pint (0.568 l)), to drain from the valve.

(7) Withdraw the valve element from the canister. Refit the drain plug to the valve element.

(8) Remove and discard the O-ring seal from the valve element.

(9) Fit a suitable blank to the canister aperture.

D. Install Valve Element (Ref. Fig.401)

(1) Observe the fuel and electrical safety precautions.

(2) Remove the blank from the canister aperture.

(3) If the same valve element is to be refitted, fit new O-ring seals, lubricated in accordance with 20-23-11, to the valve and the drain plug.

(4) Insert the valve into the canister so that its cut-outs align with the clamps, rotate the valve body counter-clockwise through 90 deg to align the valve recesses with the clamps and secure it with the clamp nuts. Torque-tighten each nut to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Torque-tighten the drain plug to between 10 and 14 lbf in (0.113 and 0.158 mdaN).

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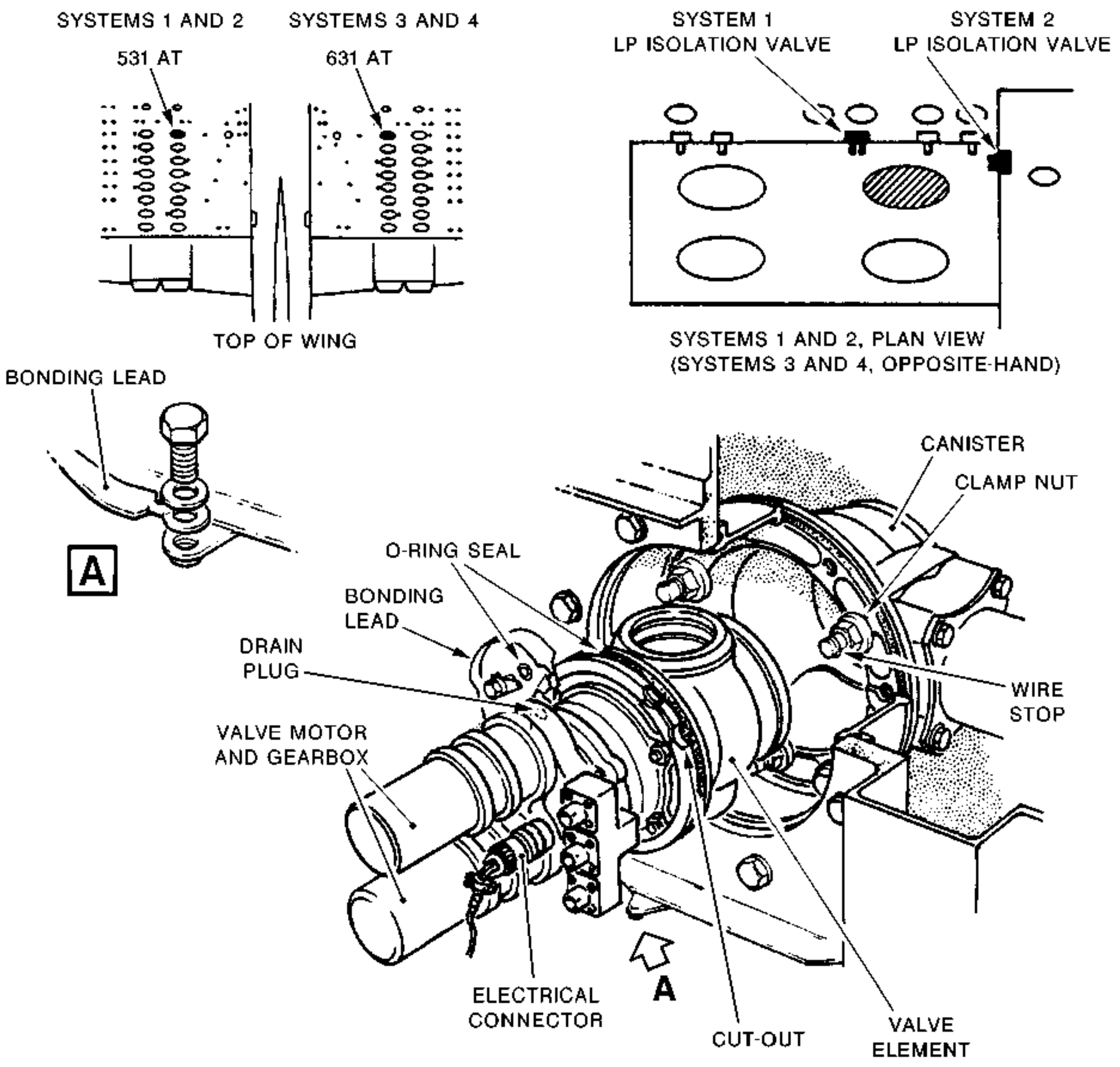

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CMB 28 21 43 4 AAM0 00

TANK NO.	6 (FOR 1)	2	3	8 (FOR 4)
ELECT. IDENT.	1Q6	2Q6	3Q6	4Q6
VALVE ELECT. IDENT. AND ASSOCIATED TANK NOS.				

LP Isolation Valve Element - Installation
Figure 401

(6) Connect the bonding lead to the aircraft bracket with the washer and bolt.

(7) Check that the electrical bonding is in accordance with 20-27-11.

(8) Connect the three electrical connectors to the valve, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Carry out a Functional Test and a Leakage Test of the valve element (Ref. Adjustment/Test).

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3. Valve Canister

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

B. Prepare to Remove Valve Canister

WARNING: OBSERVE THE AIRCRAFT OVERBALANCE SAFETY PRECAUTIONS (REF. 28-00-00, SERVICING) WHEN TRANSFERRING FUEL OR DEFUELLING).

(1) Ensure that the tank in which the canister is fitted (Ref. Table 401) is drained of fuel. Transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing), as required.

SYSTEM	TANK	ACCESS PANEL
1	6	525 CU
2	2	526 DT
3	3	626 DT
4	7	625 CU

LP Valve Canister Location
Table 401

(2) Remove the canister access panel (Ref. Table 401).

(3) Electrically isolate the engine feed pumps in the associated collector tanks by tripping the appropriate circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 MAIN PUMP SUP	1-213	1Q 834	J 3
TANK 1 ST'BY 1 PUMP SUP	4-213	1Q 835	F 5
TANK 1 ST'BY 2 PUMP SUP	13-216	1Q 836	D 1
TANK 2 MAIN PUMP SUP	1-213	2Q 834	L 3
TANK 2 ST'BY 1 PUMP SUP	4-213	2Q 835	B 5
TANK 2 ST'BY 2 PUMP SUP	14-216	2Q 836	F 4
TANK 3 MAIN PUMP SUP	1-213	3Q 834	N 3
TANK 3 ST'BY 1 PUMP SUP	4-213	3Q 835	A 8
TANK 3 ST'BY 2 PUMP SUP	14-215	3Q 836	G14
TANK 4 MAIN PUMP SUP	1-213	4Q 834	Q 3
TANK 4 ST'BY 1 PUMP SUP	4-213	4Q 835	F 8
TANK 4 ST'BY 2 PUMP SUP	13-215	4Q 836	G16

(4) Drain the fuel from the engine feed pipe to which the valve is fitted (Ref. 28-21-00, Servicing).

(5) Remove the valve element (Ref. para.2.).

C. Remove Valve Canister (Ref. Fig.402)

(1) Remove the bolted flange from each side of the canister by removing the four attachment bolts. Slide each flange, complete with circlip, along the adjoining pipe sleeve.

(2) Remove the six bolts that secure the canister to its support ring. Disengage the canister from the pipe sleeve ends and remove the canister.

D. Install Valve Canister (Ref. Fig.402)

(1) Observe the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the pipe sleeve ends that enter into the canister.

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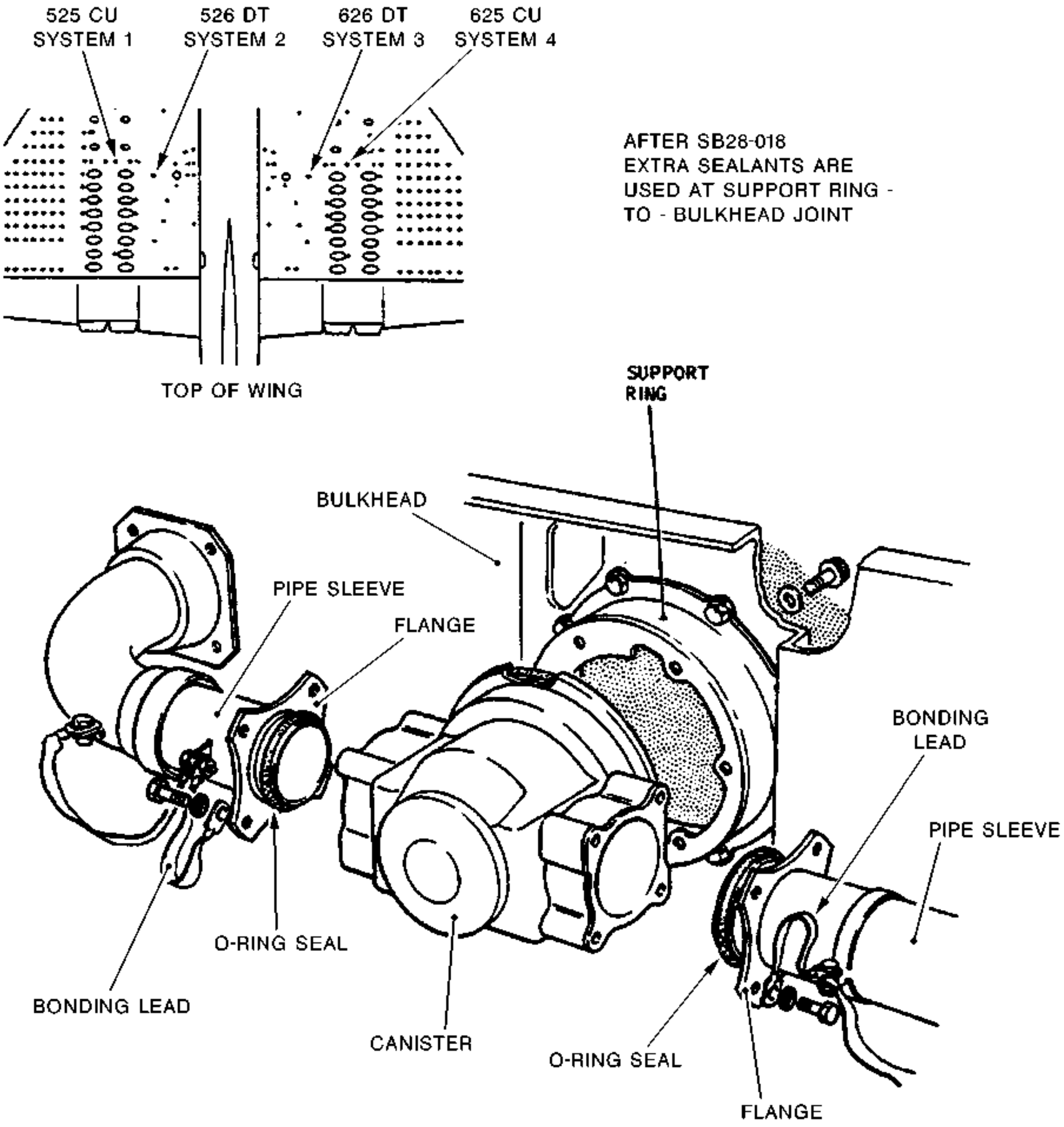

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CMB 28 21 43 4 BAM0 00

LP Isolation Valve Canister - Installation
Figure 402

(3) If the same canister is being refitted, fit a new O-ring seal, lubricated in accordance with 20-23-11, to the joint face.

(4) Locate the canister on its support ring, inserting the pipe sleeve ends into each side of the canister. Secure the canister to the support ring with the six bolts and washers. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

NOTE: The canister must be fitted the correct way up (note position of clamp nuts, (Ref. Fig. 401)), otherwise the element will be fitted inverted, with the drain plug uppermost.

(5) Secure the pipe sleeves to the canister with the bolted flanges, complete with circlips, using the four bolts and washers, and fitting the bonding lead to the bolt with the dimpled head. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Ensure that the electrical bonding is in accordance with 20-27-11.

E. Conclusion

(1) Install the valve element as detailed in paragraph 2.

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Refit the tank access panel in accordance with 53-00-00,
Removal/Installation.

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LP ISOLATION VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

1. General

There are four LP isolation valves, one for each engine feed system. They are mounted in isolation canisters and are located in the system dry bays above the engine nacelles: those valves for systems 1 and 4 are on the forward wall; those for systems 2 and 3 are on the inboard wall. Each valve has two motors, one of which is used if the other fails. The control switches are located on the fuel management panel and each has three settings: SHUT 1 for one motor, SHUT 2 for the second motor and OPEN. Each switch is normally set to OPEN and is secured in this position with a hinged guard. A magnetic indicator is fitted, and an indicator lamp provides warning of relay failure.

This topic comprises a Functional Test of the valve element and a Leakage Test of the isolation canister. Leakage tests of the valve element are included in the Functional Test.

An internal leak test of the valve is required at any engine change; this procedure is detailed in 28-21-00, Adjustment/Test.

2. Functional Test - Valve Element (Ref. Fig. 501)

A. Prepare

(1) Remove panel 531 AT or 631 AT, to gain access to the valve element in the system dry bay.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that the associated collector tank has enough space to receive at least 1,000 kg of extra fuel, and that a selected collector tank contains at least 1,500 kg of fuel. Transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing) as necessary.

(5) Record the fuel quantity indicator (FQI) readings

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for the associated and selected collector tanks.

B. Test

(1) Lower the switch-guard and set the associated LP VALVE switch to "SHUT 1"; check that, within 4 s, the adjacent magnetic indicator displays cross-line and the mechanical indicator on the valve element moves to SHUT.

(2) Set the CROSSFEED valve switches of the associated and selected collector tank systems to the 'open' (in-line) positions. Ensure that the appropriate magnetic indicators display in-line.

(3) Set the three ENGINE FEED PUMPS switches of the selected collector tank system to "ON".

(4) Check, by reference to the FQIs, that no fuel transfer takes place over a minimum period of 5 min.

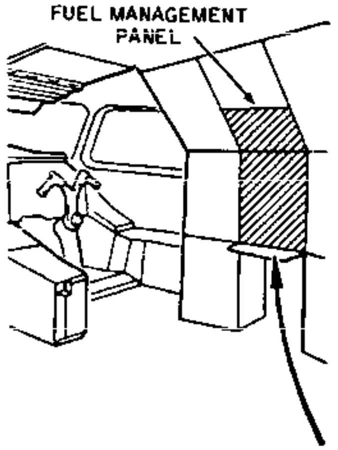
(5) Return the LP VALVE switch to "OPEN" and start to record elapsed time; check that, within 4 s, the adjacent magnetic indicator displays in-line and the mechanical indicator on the valve moves to OPEN. Continue to record elapsed time until the ENGINE FEED PUMPS are switched off.

(6) Check that, over a minimum period of 5 min, there is no leakage from any of the valve element joints.

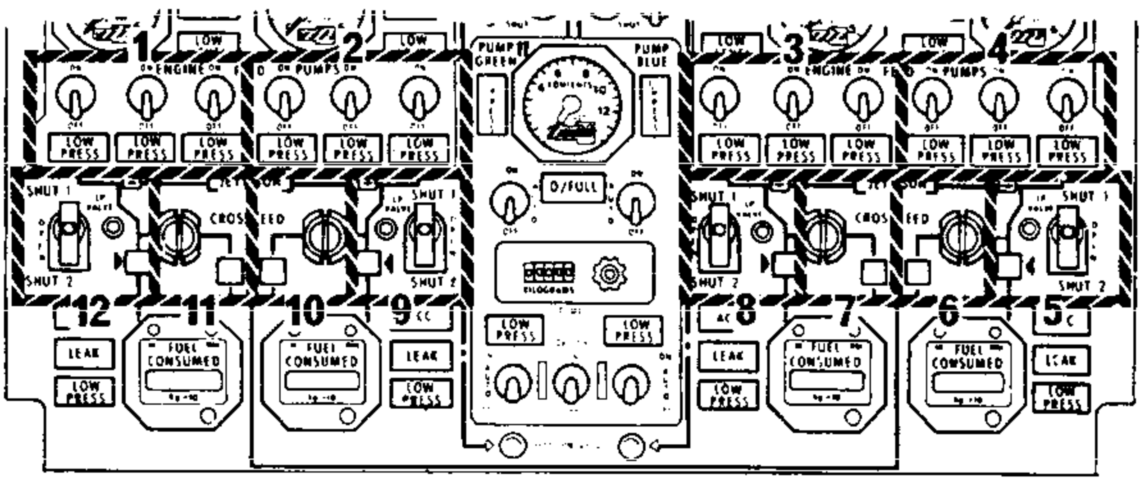
(7) When 10 min have elapsed, return the three ENGINE FEED PUMPS switches to "OFF". Check, by reference to the FQIs, that the fuel transferred into the associated collector tank is not less than 380 kg for tanks 1 or 4, or 480 kg for tanks 2 or 3.

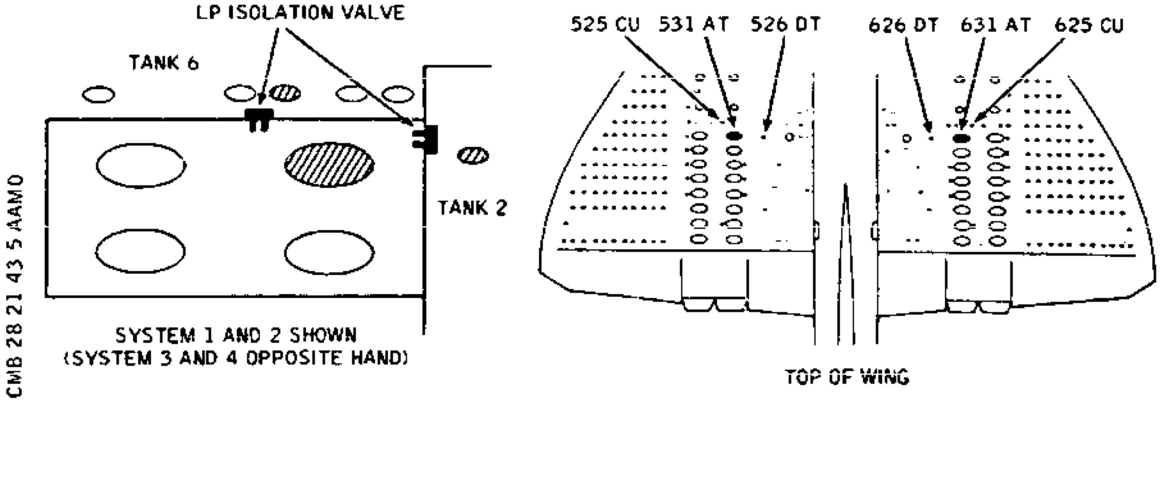
(8) Lower the switch-guard and set the associated LP VALVE switch to "SHUT 2" and then "OPEN", checking that the valve closes and opens within 4 s of the operation of the switch, and that the magnetic and mechanical indications agree with each setting of the switch. Check also that the indicator lamp next to the switch remains extinguished when the switch is at SHUT 2.

C. Conclusion



1 ENGINE FEED PUMPS (No. 1 SYSTEM) - SWITCHES AND INDICATORS
2 ENGINE FEED PUMPS (No. 2 SYSTEM) - SWITCHES AND INDICATORS
3 ENGINE FEED PUMPS (No. 3 SYSTEM) - SWITCHES AND INDICATORS
4 ENGINE FEED PUMPS (No. 4 SYSTEM) - SWITCHES AND INDICATORS
5 LP ISOLATION VALVE (No. 4 SYSTEM) - SWITCH AND INDICATOR
6 CROSS-FEED VALVE (No. 4 SYSTEM) - SWITCH AND INDICATOR
7 CROSS-FEED VALVE (No. 3 SYSTEM) - SWITCH AND INDICATOR
8 LP ISOLATION VALVE (No. 3 SYSTEM) - SWITCH AND INDICATOR
9 LP ISOLATION VALVE (No. 2 SYSTEM) - SWITCH AND INDICATOR
10 CROSS-FEED VALVE (No. 2 SYSTEM) - SWITCH AND INDICATOR
11 CROSS-FEED VALVE (No. 1 SYSTEM) - SWITCH AND INDICATOR
12 LP ISOLATION VALVE (No. 1 SYSTEM) - SWITCH AND INDICATOR





- LP Isolation Valves - Location and Control
Figure 501

(1) Return the CROSSFEED valve switches to the 'closed' (cross-line) position. Ensure that the appropriate magnetic indicators display cross-line.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Refit the access panel.

B D. Internal Leak Test - Engine Removed

B (1) Make available electrical ground power (Ref.
B 24-41-00).

B (2) Ensure there is at least 1000 kg of fuel in the
B associated collector tank.

B (3) Check LP isolation valve and associated crossfeed
B valve are SHUT.

B (4) Switch ON any one of the ENGINE FEED PUMPS in the
B associated collector tank.

B (5) Check for leakage at the disconnected engine feed
B pipe in the engine bay. No leakage is permissible
B over a 3 minute period.

B (6) At the conclusion of the test:

B (a) Set the ENGINE FEED PUMP switch to OFF.

B (b) Disconnect electrical ground power.

B E. Internal Leak Test - Engine Installed

B (1) Make available electrical ground power (Ref.
B 24-41-00).

B (2) Ensure there is at least 1000 kg of fuel in the
B associated collector tank.

B (3) Check LP isolation valve and associated crossfeed
B valve are SHUT.

B (4) Gain access to the associated recirculation LP
B control valve.

B (5) Replace bleed plug with adapter 3BA-11886.
B Direct open end of adapter tube into a suitable
B container.

B (6) Switch ON any one of the ENGINE FEED PUMPS in the associated collector tank. Observe leakage does not exceed 10 drops per minute.

B (7) At the conclusion of the test:

B (a) Remove adapter and refit bleed plug.

B (b) OPEN LP isolation valve. Observe there is no leakage from the bleed plug.

B (c) Set the ENGINE FEED PUMP switch to OFF.

B (d) Disconnect electrical ground power.

B (e) Refit the access panels.

3. Leakage Test - Isolation Canister (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable container, up to 2 pints (1 l) capacity, for fuel	-

B. Prepare

WARNING: OBSERVE THE AIRCRAFT OVERBALANCE SAFETY PRECAUTIONS (REF. 28-00-00, SERVICING) WHEN TRANSFERRING FUEL OR DEFUELLING.

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(3) The fuel tank containing the canister will have been drained (Ref. Removal/Installation), but fuel will be required in at least one collector tank for priming the associated engine feed pipe. Therefore, proceed as follows, refuelling (Ref. 12-11-28, Servicing) or transferring fuel

(Ref. 28-00-00, Servicing) as necessary:-

(a) System 1 or 4: ensure that the collector tank of the associated engine feed system contains at least 1,000 kg of fuel.

(b) System 2 or 3: ensure that the collector tank of a selected engine feed system contains at least 1,000 kg of fuel.

(4) Prime the associated engine feed pipe with fuel as follows:-

NOTE: The fuel will flow via the system recirculation LP control valve and recirculation pressure holding valve.

(a) System 1 or 4: set one of the associated ENGINE FEED PUMPS switches to "ON" for not less than 2 min.

(b) System 2 or 3: first set the CROSSFEED valve switches of the associated and selected engine feed systems to 'open' (in-line), and ensure that the appropriate magnetic indicators display in-line. Then set one of the ENGINE FEED PUMPS switches of the selected system to "ON" for not less than 2 min.

(5) Remove the recirculation pressure holding valve element (Ref. 28-21-16, Removal/Installation).

(6) Remove the appropriate access panels (Ref. Table 501).

SYSTEM	TANK	ACCESS PANELS
1	6	525 CU and 531 AT
2	2	526 DT and 531 AT
3	3	626 DT and 631 AT
4	7	625 CU and 631 AT

Access Panels
Table 501

C. Test

(1) System 1 or 4

(a) Set one of the ENGINE FEED PUMPS switches of the associated system to "ON" and check that there are no fuel leaks from any of the canister joints over a period of 5 min.

(b) Return the ENGINE FEED PUMPS switch to "OFF".

(2) System 2 or 3

NOTE: When these canisters are being checked, it must be borne in mind that there may be some fuel spray from the accumulators and, in the case of tank 2, from the crossfeed thermal expansion pipe.

(a) Set one of the ENGINE FEED PUMPS switches of the selected system to "ON" and check that there are no fuel leaks from any of the canister joints over a period of 5 min.

(b) Return the ENGINE FEED PUMPS switch to "OFF".

(c) Return the CROSSFEED valve switches to 'closed' (cross-line).

(3) Position the container under the valve element.

(4) Remove the valve element (Ref. Removal/Installation).

(5) Check that the leak rate through the canister isolating sleeve is not more than 7.6 cc/min.

(6) Refit the valve element to the canister (Ref. Removal/Installation).

D. Conclusion

(1) Ensure that the system dry bay is wiped clean of any spilled fuel.

(2) Refit the access panels (Ref. 53-00-00, Removal/Installation).

(3) Refit the recirculation pressure holding valve element (Ref. 28-21-16, Removal/Installation).

(4) Refuel the empty tank, as necessary (Ref.

12-11-28).

(5) Remove the placard from the fuel management panel.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

END OF THIS SECTION

NEXT

RECIRCULATION LP CONTROL VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

R Before SB 28-065

1. General

R The recirculation control valve, in each of the four engine
R feed systems, is located in the wing dry bay above the nacelle.
R Each valve comprises a manifold assembly, a recirculation
R valve and a combined non-return valve and filter. The element
R can be removed independently. Procedures for the removal of
R the element, the complete valve and also the filter/NRV are
R given. Each valve has electrical connections and is secured to
R the associated by-pass valve and the hydraulic system heat
R exchanger. Because of restricted access to the attachments
R between the control valve and the by-pass valve, it is
R recommended that the two valves be removed as a single unit
R and separated on the bench. The engine feed pipe must be
R drained prior to removal of the valve or element.

2. Valve Element (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Extractor tool, for recirculation valve element	D925378000
Drain equipment, for engine feed pipeline	D925377000
Key, for wing access panel	E920132000

B. Prepare to Remove Valve Element

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the recirculation LP control valve from its collector tank fuel supply by closing the low pressure fuel isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) At the fuel management panel, set the LP VALVE switch for the associated engine feed system to "SHUT 1".

(3) Attach a placard to the fuel management panel, warning that the switch settings must not be altered.

(4) Using the key, unlock and remove the appropriate panel on the wing top surface to gain access to the recirculation LP control valve (Ref. Fig. 401).

(5) Drain the fuel from the engine feed pipeline, using the drain equipment (Ref. 28-21-00, Servicing).

C. Remove Valve Element

(1) Disconnect the bonding lead from the element.

(2) Depress the valve element cap sufficiently to permit the removal of the retaining ring, and, using a small screwdriver or similar tool, ease the end of the retaining ring clear of the groove in the manifold and complete its removal with a winding action.

(3) Using the extractor tool, carefully withdraw the valve from the manifold. Unscrew and remove the tool.

<u>NOTE</u>: A considerable pull may be required to withdraw the valve.

(4) Remove and discard the O-ring seals.

D. Install Valve Element

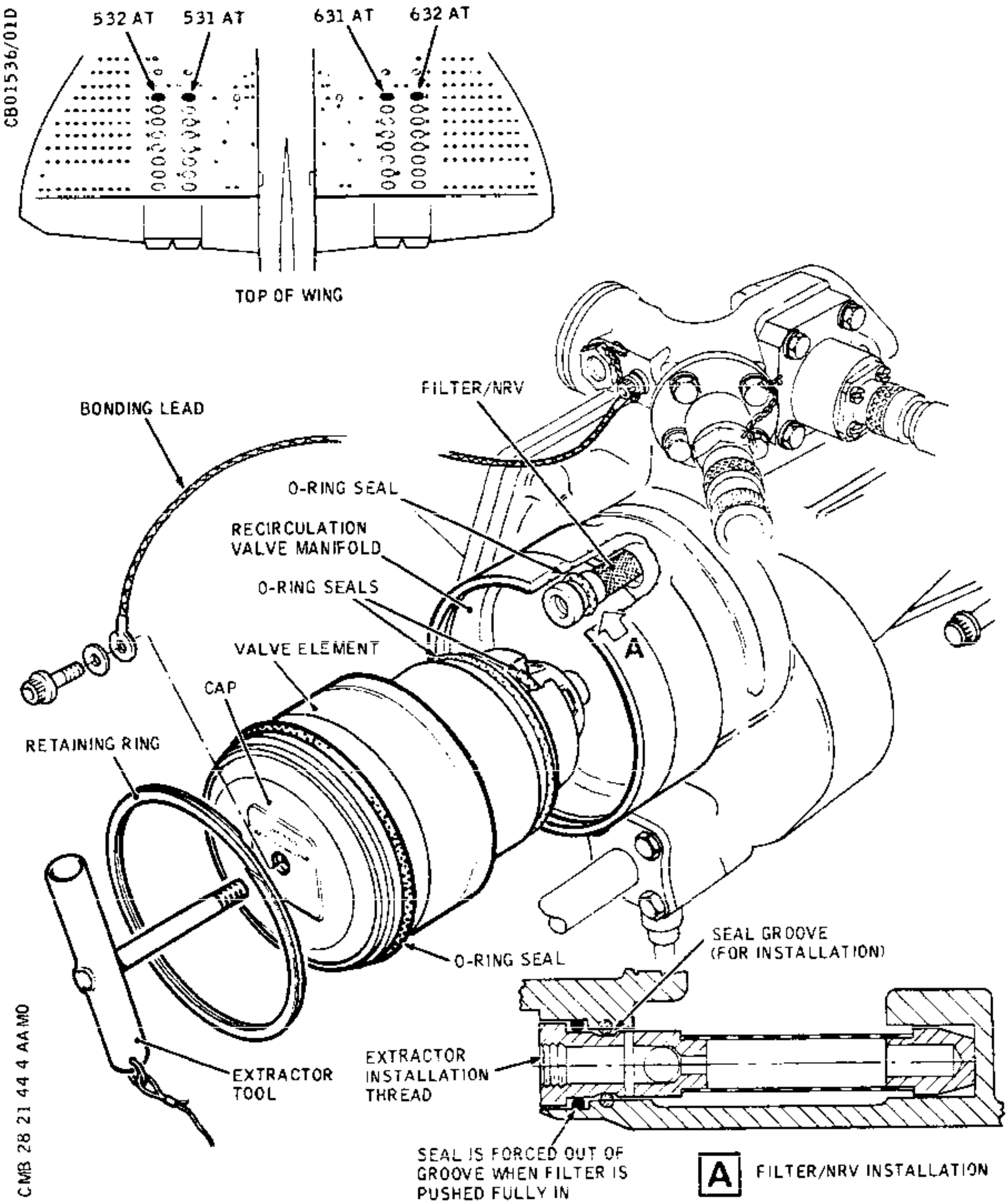
(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the valve element.

R (3) Screw the extractor tool into the cap.

R (4) Insert the element into the manifold and push the
R element fully in against the 'spring-load' effect
R of the O-ring seals.

R (5) Fit the retaining ring by inserting the inner leaf



R - Valve Element - Installation
Figure 401

R first, and then progressively feed the ring
R circumferentially into the groove.

R (6) Ensure that the retaining ring is correctly inserted,
R especially at the joggle. Check the element for
R security by giving a firm pull on the tool handle.

R (7) Unscrew and remove the extractor tool.

R (8) Connect the bonding lead to the element, and check
R that the bonding is in accordance with 20-27-11.

E. Conclusion

(1) Remove the warning placard from the fuel management panel.

(2) Open the fuel low pressure isolation valve as follows:-

(a) Ensure that electrical ground power is still available.

(b) At the fuel management panel, set the LP VALVE switch to "OPEN".

(3) Carry out a Functional Test and a Leakage Test of the valve element (Ref. Adjustment/Test).

3. Filter/Non-return Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable bolt, 1/4-28 UNF, for removal/installation of filter	Local manufacture

B. Prepare to Remove Filter/Non-return Valve

(1) Remove the valve element (Ref. para.2.).

C. Remove Filter/Non-return Valve

(1) Screw the suitable bolt, not less than four complete turns, into the filter.

(2) Firmly pull the filter, complete with O-ring seal, from its housing.

(3) Remove the bolt from the filter and remove and discard the O-ring seal.

D. Install Filter/Non-return Valve

(1) Ensure that the filter is clean and undamaged.

(2) Screw the suitable bolt, not less than four complete turns, into the filter.

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the filter.

(4) Firmly push the filter completely into its housing.

E. Conclusion

(1) Refit the valve element (Ref. para.2.).

4. Recirculation LP Control Valve (Ref. Fig. 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Drain equipment, for engine feed pipeline	D925377000
Key, for wing access panel	E920132000
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 80 to 89 lbf in (0.904 to 1.006 mdaN)	-

B. Prepare to Remove Control Valve

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00,

Servicing).

(2) Isolate the control valve from its collector tank fuel supply by closing the low pressure fuel isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) At the fuel management panel, set the LP VALVE switch for the associated engine feed system to "SHUT 1".

(3) Electrically isolate the by-pass valve and the recirculation valve temperature sensors by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine 1			
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24
FUEL TEMP IND	15-215	D1	B25
GRP 1 FUEL VALVE CONT	2-213	1H863	D16
GRP 1 TEMP SELECTOR AUTO SUP AND CONT	2-213	H1000	B17
Engine 2			
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
FUEL TEMP IND	15-215	D1	B25
GRP 2 FUEL VALVE CONT	4-213	2H863	E12
GRP 2 TEMP SELECTOR AUTO SUP AND CONT	4-213	H1001	E11

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine 3			
ENG 3 BY-PASS VALVE SUP & IND	15-215	3Q762	F25
FUEL TEMP IND	15-215	D1	B25
GRP 3 TEMP SELECTOR AUTO SUP & CONT	2-213	H1002	G16
GRP 3 FUEL VALVE CONT	2-213	3H863	F16
Engine 4			
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6
FUEL TEMP IND	15-215	D1	B25
GRP 4 TEMP SELECTOR AUTO SUP & CONT	4-213	H1003	B12
GRP 4 FUEL VALVE CONT	4-213	4H863	B11

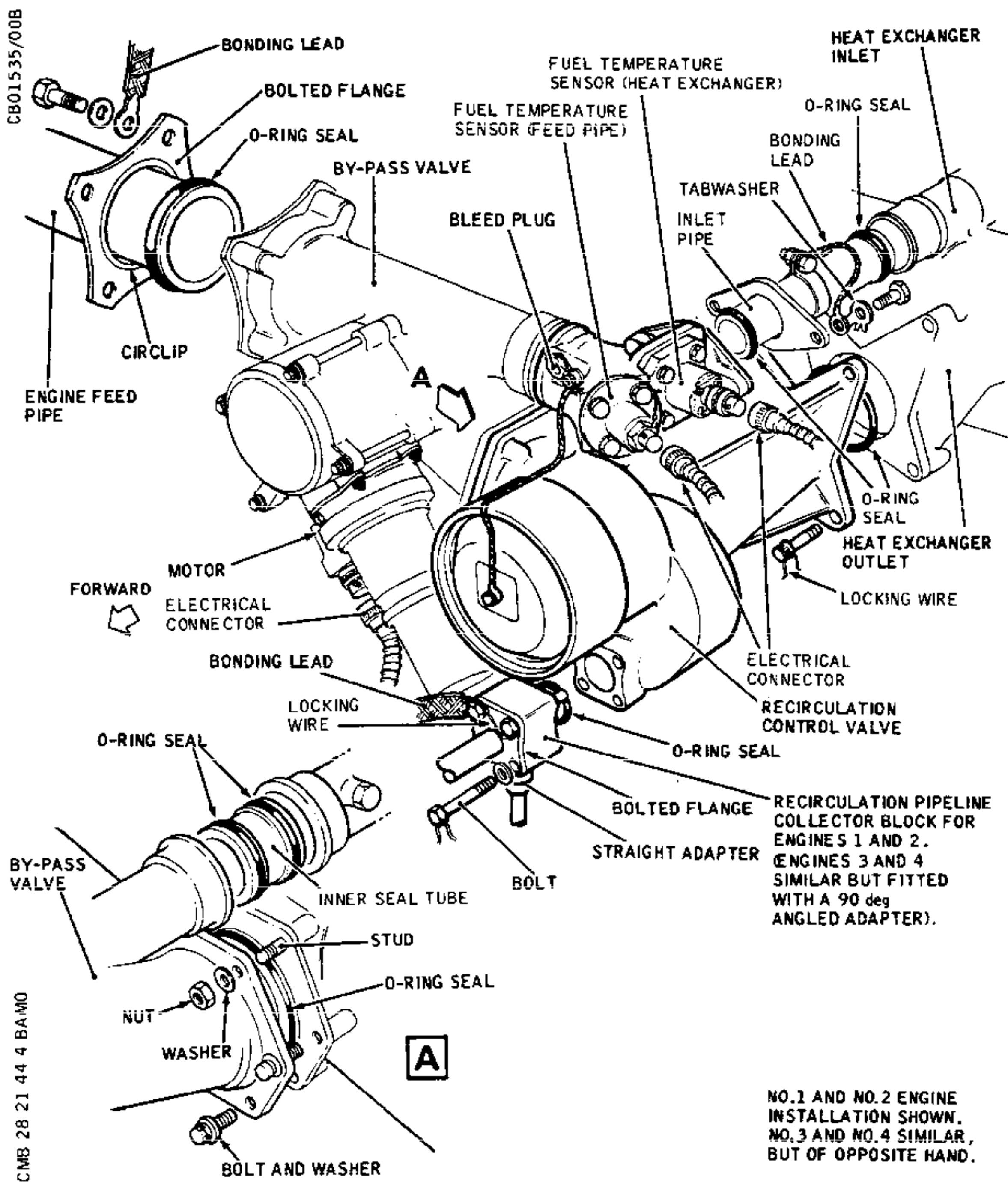
(4) Attach a placard to the fuel management panel, warning that the switch settings must not be altered.

(5) Using the key, unlock and remove the appropriate panel on the wing top surface to gain access to the recirculation LP control valve (Ref. Fig. 401).

(6) Drain the fuel from the engine feed pipeline, using the drain equipment (Ref. 28-21-00, Servicing).

(7) Remove the extinguisher bottles (Ref. 26-21-11, Removal/Installation).

C. Remove Control Valve



- Recirculation LP Control Valve - Installation
Figure 402

(1) Disconnect the electrical connectors from the by-pass valve motor and the two temperature sensors on the recirculation control valve.

(2) Disconnect the by-pass valve from the engine feed pipe by removing the bolts securing the bolted flange and bonding lead; slide the bolted flange and the circlip clear of the joint.

(3) To assist the disconnection of the recirculation pipeline collector block, remove sufficient pipe support clips from the associated small-bore pipes. During removal note the positions of the clips. Retain the clips with their bolts, washers and, where applicable, the bonding strips.

(4) Remove the four bolts and washers securing the recirculation pipeline collector block to the control valve.

(5) Support the valve and remove the four bolts and washers securing the control valve to the heat exchanger.

(6) Withdraw the control valve and the by-pass valve from the heat exchanger and the engine feed pipe respectively. Remove the two valves through the access panel aperture.

(7) Remove the two bolts and tabwashers securing the inlet pipe and bonding lead to the control valve; remove the pipe and discard the tabwashers.

(8) Remove and discard the O-ring seals from the inlet pipe.

(9) Disassemble the by-pass valve from the control valve by removing the four bolts and two nuts securing the by-pass valve outlet duct flange (Detail A), and withdraw the by-pass valve from the control valve.

(10) Remove the inner seal tube; remove and discard the O-ring seals from the tube and from the control valve inlet and outlet ports.

(11) Remove the feed pipe fuel temperature sensor (Ref. 28-45-12).

(12) Remove the heat exchanger fuel temperature sensor (Ref. 21-13-32).

(13) Remove the valve element (Ref. para.2.C.).

(14) Fit suitable blanks to all open pipes and valve apertures.

D. Prepare to Install Control Valve

(1) Remove the blanks from the pipes and valve apertures.

(2) Fit the feed pipe fuel temperature sensor to the control valve as detailed in 28-45-12, Removal/ Installation.

(3) Fit the heat exchanger fuel temperature sensor to the control valve as detailed in 21-13-32, Removal/Installation.

CAUTION: THE BY-PASS VALVE GEARBOX MUST BE PRIMED WITH FUEL BEFORE ASSEMBLY TO THE AIRCRAFT. OBSERVE THE APPLICABLE BY-PASS VALVE INSTALLATION PROCEDURES DETAILED IN 28-21-41, REMOVAL/INSTALLATION, PARAGRAPH 4.

(4) If installing a new control valve, proceed as follows:-

(a) Remove the filter/non-return valve assembly and seals from the bag attached to the control valve.

(b) Assemble the filter/non-return valve to the control valve manifold (Ref. para.3.).

(5) Assemble the by-pass valve to the control valve (Detail A), as follows:-

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the inner seal tube and the control valve inlet port; insert the tube into the by-pass valve.

(b) Insert the other end of the inner seal tube into the control valve, locating the by-pass valve flange on the two studs; secure the valves to each other with the washers, two nuts and four bolts. Torque-tighten each nut and bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the inlet pipe; secure the pipe and bonding lead to the control valve with the two bolts

and new tabwashers. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and lock it with the tabwasher in accordance with 20-21-17.

(7) Install the valve element (Ref. para.2.D.).

E. Install Combined Control Valve and By-pass Valve

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe, the inlet pipe and the control valve outlet port.

(3) Support the valves in position, inserting the engine feed pipe into the by-pass valve and the inlet pipe on the control valve into the heat exchanger.

(4) Secure the control valve to the heat exchanger with the four bolts and washers, ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 80 and 89 lbf in (0.904 and 1.006 mdaN) and wire-lock them in accordance with 20-21-13.

(5) Secure the by-pass valve to the engine feed pipe with the four bolts and washers, ensuring that the bonding lead is correctly positioned beneath the bolt with the dimpled head. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit a new O-ring seal, lubricated in accordance with 20-23-11, on the recirculation pipeline collector block and refit the block to the control valve, ensuring that the bonding lead is correctly positioned beneath the appropriate bolt-head; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock them in accordance with 20-21-13.

(7) Refit, in the positions noted during removal, the pipe support clips on the small-bore piping associated with the recirculation pipeline collector block. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(8) Check that all pipes and components are bonded in

accordance with 20-27-11.

(9) Connect the electrical connectors to the by-pass valve and the two fuel temperature sensors, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Remove the warning placard from the fuel management panel.

(3) Set the LP VALVE switch to "OPEN".

(4) Carry out a check for satisfactory operation of the by-pass valve motor, including freedom from leakage, as detailed in 28-21-41, Removal/Installation.

(5) Carry out a Functional Test and a Leakage Test of the control valve (Ref. Adjustment/Test).

(6) Carry out an Operational Test of the feed pipe fuel temperature sensor (Ref. 28-45-00, Adjustment/Test).

(7) Carry out a Functional Test of the heat exchanger fuel temperature sensor (Ref. 21-13-32).

(8) Refit the extinguisher bottles (Ref. 26-21-11).

(9) Refit the access panel and lock it, using the key.

(10) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R After SB 28-065 For A/C 001-007,

R NOTE: SB 28-065 introduces a brace assembly to the manifold of the recirculation control valve. The brace is used to strengthen the manifold casting in the area of the groove for the control valve retaining ring.

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

R 1. General

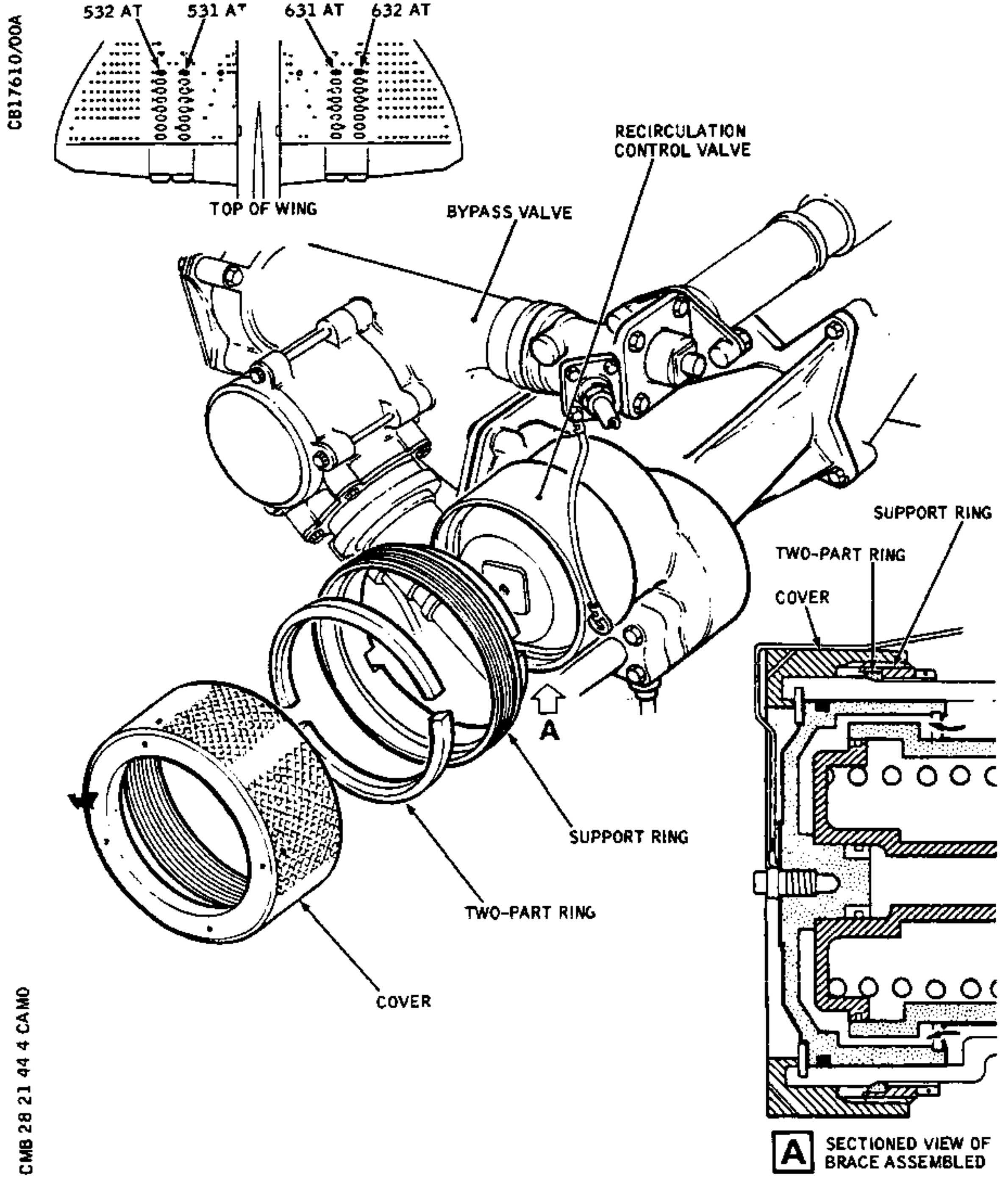
R The recirculation control valve, in each of the four engine feed systems, is located in the wing dry bay above the nacelle. Each valve comprises a manifold assembly, a recirculation valve, a combined non-return valve and filter and a brace assembly. The element can be removed independently. Procedures for the removal of the brace assembly, the element, the complete valve and also the filter/NRV are given. Each valve has electrical connections and is secured to the associated by-pass valve and the hydraulic system heat exchanger. Because of restricted access to the attachments between the control valve and the by-pass valve, it is recommended that the two valves be removed as a single unit and separated on the bench. The engine feed pipe must be drained prior to removal of the valve or element.

R 2. Brace Assembly (Ref. Fig. 403)

R A. Equipment and Materials

DESCRIPTION	PART NO.
Key, for wing access panel	E920132000
C-spanner, for support ring	-
Petroleum jelly (Ref. 20-30-00, No.27)	-

R B. Prepare to Remove Brace Assembly



Brace Assembly - Installation
After SB 28-065
Figure 403

R

(1) Using the key, unlock and remove the appropriate panel on the wing top surface to gain access to the brace assembly (Ref. Fig. 403).

C. Remove Brace Assembly

(1) Remove the locking wire securing the cover and support ring.

(2) Disconnect the bonding lead from the valve element.

(3) Hold the support ring with the C-spanner and unscrew the cover by hand.

(4) Slide the support ring back over the smaller diameter of the manifold and remove both halves of the two-part ring from the support ring.

(5) Slide the support ring over the larger diameter of the manifold and remove the ring. Retain the removed items for reassembly.

D. Prepare to Install Brace Assembly

(1) Ensure that the valve manifold is clean.

(2) Ensure that the component parts of the brace assembly are clean; pay particular attention to the threaded portions of the cover and support ring.

(3) Using petroleum jelly, lightly lubricate the threads of the cover and support ring; also, lightly lubricate the two-part ring.

E. Install Brace Assembly

(1) Slide the support ring, with its non-threaded end leading, over the manifold and onto the manifold smaller diameter.

(2) Fit both halves of the two-part ring into the threaded end of the support ring. Ensure that the internal chamfer of the two-part ring faces toward the manifold shoulder.

(3) Slide the support ring toward the larger diameter of the manifold until the two-part ring chamfer contacts the manifold shoulder.

(4) Screw the cover onto the support ring. Restrain

R the support ring with the C-spanner and hand-tighten the cover until the rings are firmly secured.

R NOTE: It is not necessary to employ any form of spanner on the cover.

R (5) Using the most suitably positioned pair of holes, wire-lock the support ring and cover together in accordance with 20-21-13.

R (6) Connect the bonding lead to the valve element and check that the bonding is in accordance with 20-27-11.

R 3. Valve Element (Ref. Fig. 404)

R A. Equipment and Materials

DESCRIPTION	PART NO.
Extractor tool, for recirculation valve element	D925378000
Drain equipment, for engine feed pipeline	D925377000
Key, for wing access panel	E920132000

R B. Prepare to Remove Valve Element

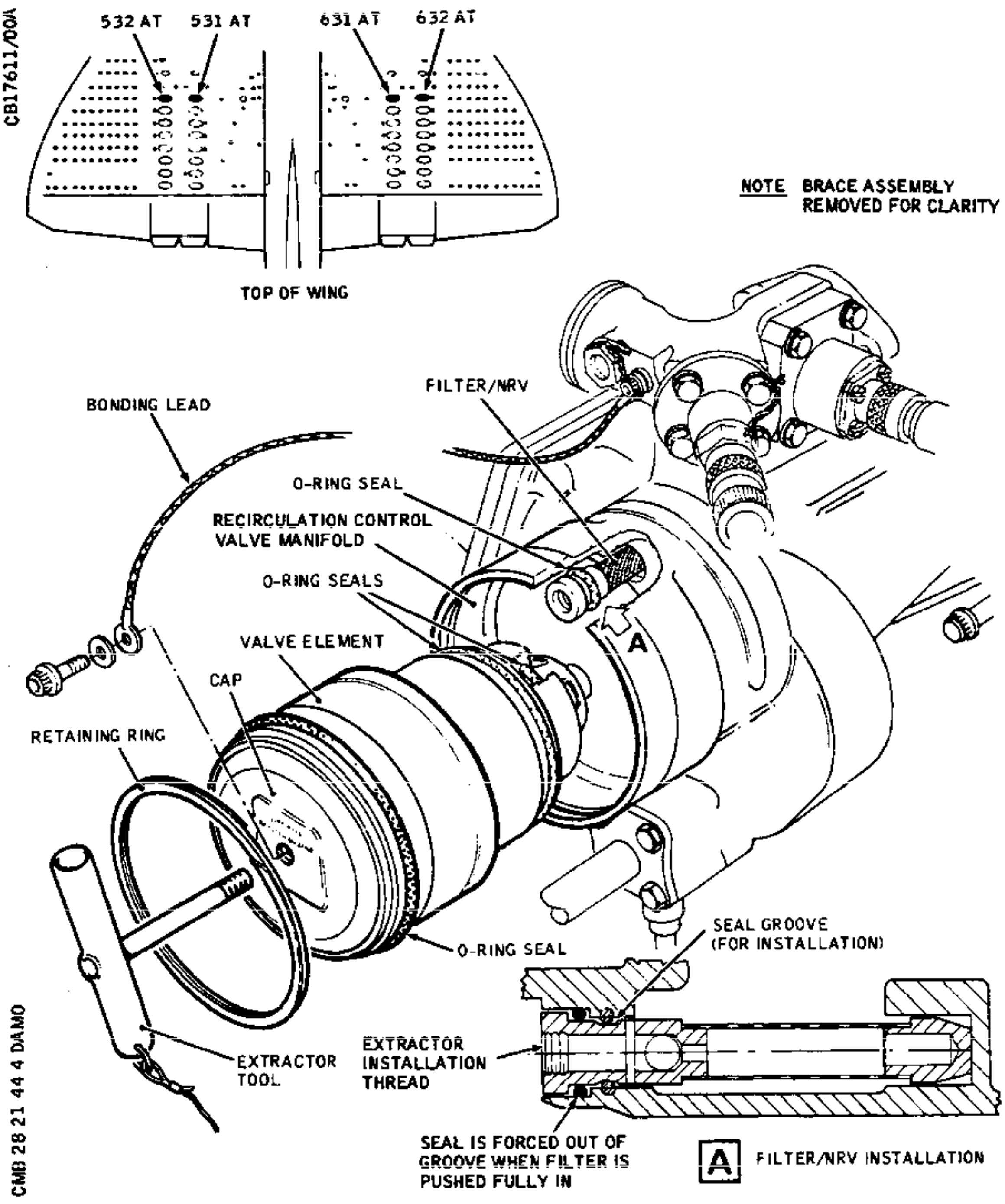
R (1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (2) Isolate the recirculation LP control valve from its collector tank fuel supply by closing the low pressure fuel isolation valve, as follows:-

R (a) Make available electrical ground power as detailed in 24-41-00.

R (b) At the fuel management panel, set the LP VALVE switch for the associated engine feed system to "SHUT 1".

R (3) Attach a placard to the fuel management panel, warning that the switch settings must not be altered.



\- Valve Element - Installation
After SB 28-065
Figure 404

R

(4) Using the key, unlock and remove the appropriate panel on the wing top surface to gain access to the recirculation LP control valve (Ref. Fig. 404).

(5) Drain the fuel from the engine feed pipeline, using the drain equipment (Ref. 28-21-00, Servicing).

(6) Remove the brace assembly (Ref. para.2.).

C. Remove Valve Element

(1) Disconnect the bonding lead from the element.

(2) Depress the valve element cap sufficiently to permit the removal of the retaining ring, and, using a small screwdriver or similar tool, ease the end of the retaining ring clear of the groove in the manifold and complete its removal with a winding action.

(3) Using the extractor tool, carefully withdraw the valve from the manifold. Unscrew and remove the tool.

NOTE: A considerable pull may be required to withdraw the valve.

(4) Remove and discard the O-ring seals.

D. Install Valve Element

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the valve element.

(3) Screw the extractor tool into the cap.

(4) Insert the element into the manifold and push the element fully in against the 'spring-load' effect of the O-ring seals.

(5) Fit the retaining ring by inserting the inner leaf first, and then progressively feed the ring circumferentially into the groove.

(6) Ensure that the retaining ring is correctly inserted, especially at the joggle. Check the element for security by giving a firm pull on the tool handle.

(7) Unscrew and remove the extractor tool.

R (8) Refit the brace assembly (Ref. para.2.).

R E. Conclusion

R (1) Remove the warning placard from the fuel management panel.

R (2) Open the fuel low pressure isolation valve as follows:-

R (a) Ensure that electrical ground power is still available.

R (b) At the fuel management panel, set the LP VALVE switch to "OPEN".

R (3) Carry out a Functional Test and a Leakage Test of the valve element (Ref. Adjustment/Test).

R 4. Filter/Non-return Valve (Ref. Fig. 404)

R A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable bolt, 1/4-28 UNF, for removal/installation of filter	Local manufacture

R B. Prepare to Remove Filter/Non-return Valve

R (1) Remove the brace assembly and valve element (Ref. paras.2. and 3.).

R C. Remove Filter/Non-return Valve

R (1) Screw the suitable bolt, not less than four complete turns, into the filter.

R (2) Firmly pull the filter, complete with O-ring seal, from its housing.

R (3) Remove the bolt from the filter and remove and discard the O-ring seal.

R D. Install Filter/Non-return Valve

R (1) Ensure that the filter is clean and undamaged.

(2) Screw the suitable bolt, not less than four complete turns, into the filter.

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the filter.

(4) Firmly push the filter completely into its housing.

E. Conclusion

(1) Refit the valve element and brace assembly (Ref. paras.3. and 2.).

5. <u>Recirculation LP Control Valve</u> (Ref. Fig. 405)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Drain equipment, for engine feed pipeline	D925377000
Key, for wing access panel	E920132000
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 80 to 89 lbf in (0.904 to 1.006 mdaN)	-

B. Prepare to Remove Control Valve

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the control valve from its collector tank fuel supply by closing the low pressure fuel isolation valve, as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) At the fuel management panel, set the LP VALVE switch for the associated engine feed system to "SHUT 1".

(3) Electrically isolate the by-pass valve and the recirculation valve temperature sensors by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine 1			
ENG 1 BY-PASS VALVE SUP & IND	15-215	1Q762	F24
FUEL TEMP IND	15-215	D1	B25
GRP 1 FUEL VALVE CONT	2-213	1H863	D16
GRP 1 TEMP SELECTOR AUTO SUP AND CONT	2-213	H1000	B17
Engine 2			
ENG 2 BY-PASS VALVE SUP & IND	15-216	2Q762	E5
FUEL TEMP IND	15-215	D1	B25
GRP 2 FUEL VALVE CONT	4-213	2H863	E12
GRP 2 TEMP SELECTOR AUTO SUP AND CONT	4-213	H1001	E11
Engine 3			
ENG 3 BY-PASS VALVE SUP & IND	15-215	3Q762	F25
FUEL TEMP IND	15-215	D1	B25
GRP 3 TEMP SELECTOR AUTO	2-213	H1002	G16

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP & CONT			
GRP 3 FUEL VALVE CONT	2-213	3H863	F16
Engine 4			
ENG 4 BY-PASS VALVE SUP & IND	15-216	4Q762	E6
FUEL TEMP IND	15-215	D1	B25
GRP 4 TEMP SELECTOR AUTO SUP & CONT	4-213	H1003	B12
GRP 4 FUEL VALVE CONT	4-213	4H863	B11

(4) Attach a placard to the fuel management panel, warning that the switch settings must not be altered.

(5) Using the key, unlock and remove the appropriate panel on the wing top surface to gain access to the recirculation LP control valve (Ref. Fig. 403).

(6) Drain the fuel from the engine feed pipeline, using the drain equipment (Ref. 28-21-00, Servicing).

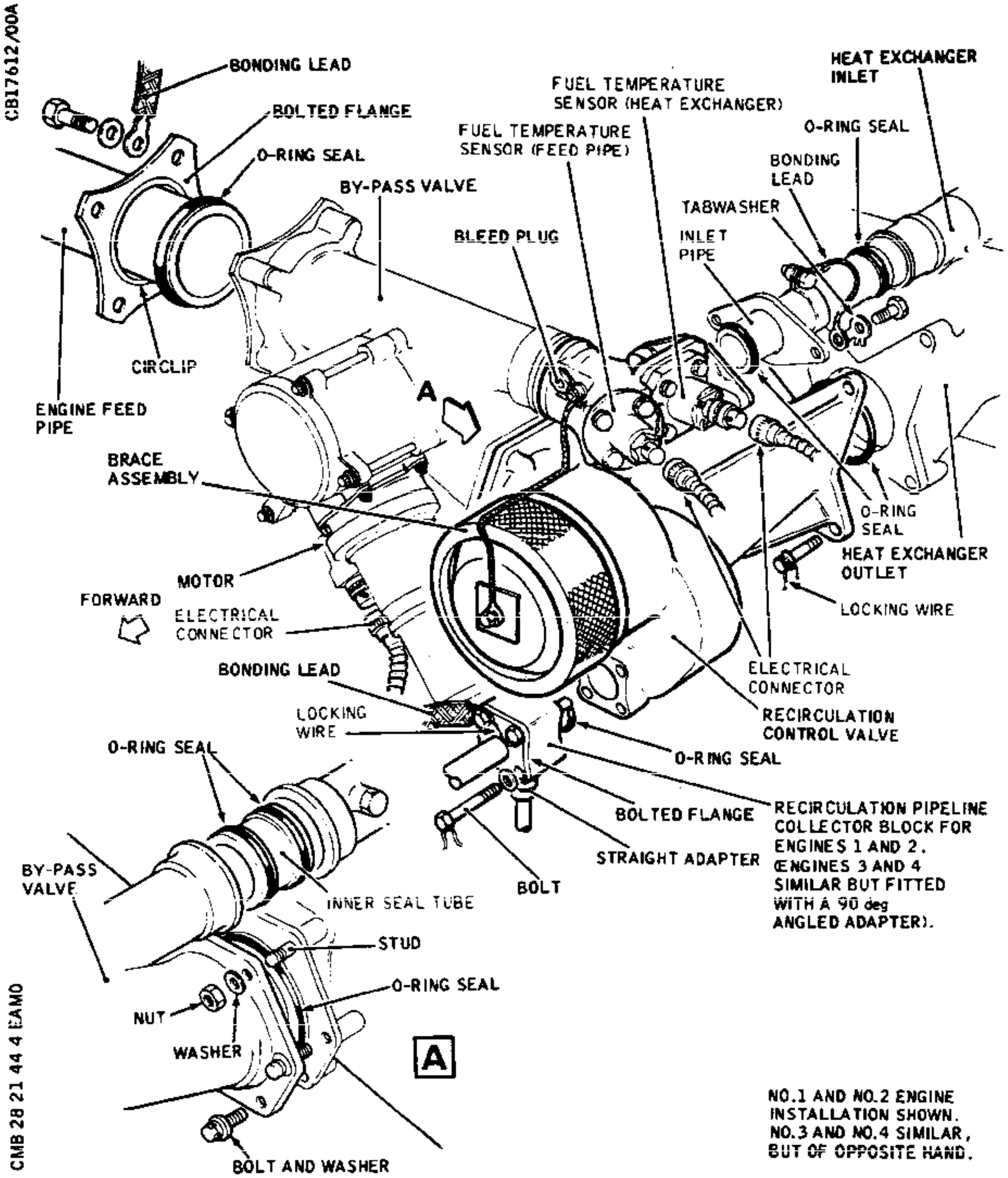
(7) Remove the extinguisher bottles (Ref. 26-21-11, Removal/Installation).

(8) Remove and retain the brace assembly (Ref. para.2.).

C. Remove Control Valve

(1) Disconnect the electrical connectors from the by-pass valve motor and the two temperature sensors on the recirculation control valve.

(2) Disconnect the by-pass valve from the engine feed pipe by removing the bolts securing the bolted flange and



- Recirculation LP Control Valve - Installation
After SB 28-065
Figure 405

R

bonding lead; slide the bolted flange and the circlip clear of the joint.

(3) To assist the disconnection of the recirculation pipeline collector block, remove sufficient pipe support clips from the associated small-bore pipes. During removal note the positions of the clips. Retain the clips with their bolts, washers and, where applicable, the bonding strips.

(4) Remove the four bolts and washers securing the recirculation pipeline collector block to the control valve.

(5) Support the valve and remove the four bolts and washers securing the control valve to the heat exchanger.

(6) Withdraw the control valve and the by-pass valve from the heat exchanger and the engine feed pipe respectively. Remove the two valves through the access panel aperture.

(7) Remove the two bolts and tabwashers securing the inlet pipe and bonding lead to the control valve; remove the pipe and discard the tabwashers.

(8) Remove and discard the O-ring seals from the inlet pipe.

(9) Disassemble the by-pass valve from the control valve by removing the four bolts and two nuts securing the by-pass valve outlet duct flange (Detail A), and withdraw the by-pass valve from the control valve.

(10) Remove the inner seal tube; remove and discard the O-ring seals from the tube and from the control valve inlet and outlet ports.

(11) Remove the feed pipe fuel temperature sensor (Ref. 28-45-12).

(12) Remove the heat exchanger fuel temperature sensor (Ref. 21-13-32).

(13) Remove the valve element (Ref. para.3.C.).

(14) Fit suitable blanks to all open pipes and valve apertures.

D. Prepare to Install Control Valve

(1) Remove the blanks from the pipes and valve apertures.

(2) Fit the feed pipe fuel temperature sensor to the control valve as detailed in 28-45-12, Removal/ Installation.

(3) Fit the heat exchanger fuel temperature sensor to the control valve as detailed in 21-13-32, Removal/Installation.

<u>CAUTION</u>: THE BY-PASS VALVE GEARBOX MUST BE PRIMED WITH FUEL BEFORE ASSEMBLY TO THE AIRCRAFT. OBSERVE THE APPLICABLE BY-PASS VALVE INSTALLATION PROCEDURES DETAILED IN 28-21-41, REMOVAL/INSTALLATION, PARAGRAPH 4.

(4) If installing a new control valve, proceed as follows:-

(a) Remove the filter/non-return valve assembly and seals from the bag attached to the control valve.

(b) Assemble the filter/non-return valve to the control valve manifold (Ref. para.4.).

(5) Assemble the by-pass valve to the control valve (Detail A), as follows:-

(a) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the inner seal tube and the control valve inlet port; insert the tube into the by=pass valve.

(b) Insert the other end of the inner seal tube into the control valve, locating the by-pass valve flange on the two studs; secure the valves to each other with the washers, two nuts and four bolts. Torque-tighten each nut and bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the inlet pipe; secure the pipe and bonding lead to the control valve with the two bolts and new tabwashers. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and lock it with the tabwasher in accordance with 20-21-17.

(7) Install the valve element (Ref. para.3.D.).

(8) Assemble the brace assembly (Ref. para.2.).

E. Install Combined Control Valve and By-pass Valve

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the engine feed pipe, the inlet pipe and the control valve outlet port.

(3) Support the valves in position, inserting the engine feed pipe into the by-pass valve and the inlet pipe on the control valve into the heat exchanger.

(4) Secure the control valve to the heat exchanger with the four bolts and washers, ensuring that the bonding bolt is correctly positioned; torque-tighten the bolts to between 80 and 89 lbf in (0.904 and 1.006 mdaN) and wire-lock them in accordance with 20-21-13.

(5) Secure the by-pass valve to the engine feed pipe with the four bolts and washers, ensuring that the bonding lead is correctly positioned beneath the bolt with the dimpled head. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Fit a new O-ring seal, lubricated in accordance with 20-23-11, on the recirculation pipeline collector block and refit the block to the control valve, ensuring that the bonding lead is correctly positioned beneath the appropriate bolt-head; torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock them in accordance with 20-21-13.

(7) Refit, in the positions noted during removal, the pipe support clips on the small-bore piping associated with the recirculation pipeline collector block. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(8) Check that all pipes and components are bonded in accordance with 20-27-11.

(9) Connect the electrical connectors to the by-pass

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R valve and the two fuel temperature sensors, ensuring
R that the mating surfaces are clean and undamaged.

R F. Conclusion

R (1) Reset the circuit breakers previously tripped.

R (2) Remove the warning placard from the fuel management
R panel.

R (3) Set the LP VALVE switch to "OPEN".

R (4) Carry out a check for satisfactory operation of the
R by-pass valve motor, incldning freedom from leakage,
R as detailed in 28-21-41, Removal/Installation.

R (5) Carry out a Functional Test and a Leakage Test of the
R control valve (Ref. Adjustment/Test).

R (6) Carry out an Operational Test of the feed pipe fuel
R temperature sensor (Ref. 28-45-00, Adjustment/Test).

R (7) Carry out a Functional Test of the heat exchanger
R fuel temperature sensor (Ref. 21-13-32).

R (8) Refit the extinguisher bottles (Ref. 26-21-11).

R (9) Refit the access panel and lock it, using the key.

R (10) Switch off and disconnect electrical ground power
R as detailed in 24-41-00.

RECIRCULATION LP CONTROL VALVE - ADJUSTMENT/TEST

1. General

When the fuel demand from the engine is minimal the recirculation control valve automatically recirculates the excess fuel back to the collector tank thereby ensuring that a constant fuel flow is maintained through the heat exchangers. The valve is installed between the by-pass valve and the hydraulic heat exchanger in the wing dry bay of each feed system.

2. Recirculation Control Valve

A. Function Test the Valve

(1) Make available electrical ground power (Ref. 24-41-00).

(2) Prove the flow through the valve:

(a) Ensure that the collector tank for the system with the valve under test is at least 25 per cent empty and set the associated CROSSFEED valve to open (in line).

(b) Ensure that any one of the remaining three collector tanks is at least 25 per cent full and set its system CROSSFEED valve to open and its ENGINE FEED PUMPS switches to "ON".

NOTE: With this setting fuel will transfer from one tank to the other via the crossfeed and recirculation pipelines.

(c) Check from the fuel gauges that fuel is flowing into the associated collector tank.

(d) At the conclusion of the check:

(a) Set the ENGINE FEED PUMPS switches to "OFF".

(b) Set the CROSSFEED valves switches to shut (crossline).

(c) Switch off and disconnect electrical ground power.

(3) During the next engine run or with engine simulated by PEST rig, feed the associated engine with fuel from an adjacent collector tank using the control settings as in 2A(2), to give a fuel flow of more than 6500 lb

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(2947 kg) per hour. Check from the fuel gauges that there is no increase in the contents of the associated collector tank. At the completion of the test return the CROSSFEED valve switches to their normal ground setting.

B. Leak Test the Valve Element

(1) Make available electrical ground power (Ref. 24-4100).

(2) Remove the appropriate panel to gain access to the valve.

(3) Set the associated ENGINE FEED PUMPS switches to "ON" and check that there is no leakage from the valve.

(4) At the completion of the test:

(a) Set the ENGINE FEED PUMPS switches to "OFF".

(b) Refit the access panel.

(c) Switch off and disconnect ground electrical power.

C. Leak Test the Valve Manifold

(1) Check the valve manifold joints for leakage by carrying out the leakage test given for the engine feed and recirculation pipelines (Ref. 28-21-00, Adjustment/Test).

RECIRCULATION NON-RETURN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The recirculation non-return valve for each engine feed system is located in the floor of the associated dry bay above the nacelle.

2. Non-return Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Drain equipment, for engine feed pipeline	D924377000
Circuit breaker safety clips	-
Key, for wing access panel	E920132000
Torque spanner, 35 to 44 lbf in (0.395 to o.497 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Torque spanner, 445 to 455 lbf in (5.028 to 5.141 mdaN)	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Isolate the recirculation non-return valve from its collector tank fuel supply by closing the LP

isolation valve as follows:-

(a) Make available electrical ground power as detailed in 24-41-00.

(b) Set the LP VALVE switch for the engine feed system to "SHUT 1".

(3) Place a placard at the panel warning that the settings of the switches must not be altered.

(4) Electrically isolate the LP isolation valve by tripping the appropriate circuit breakers; fit safety clips.

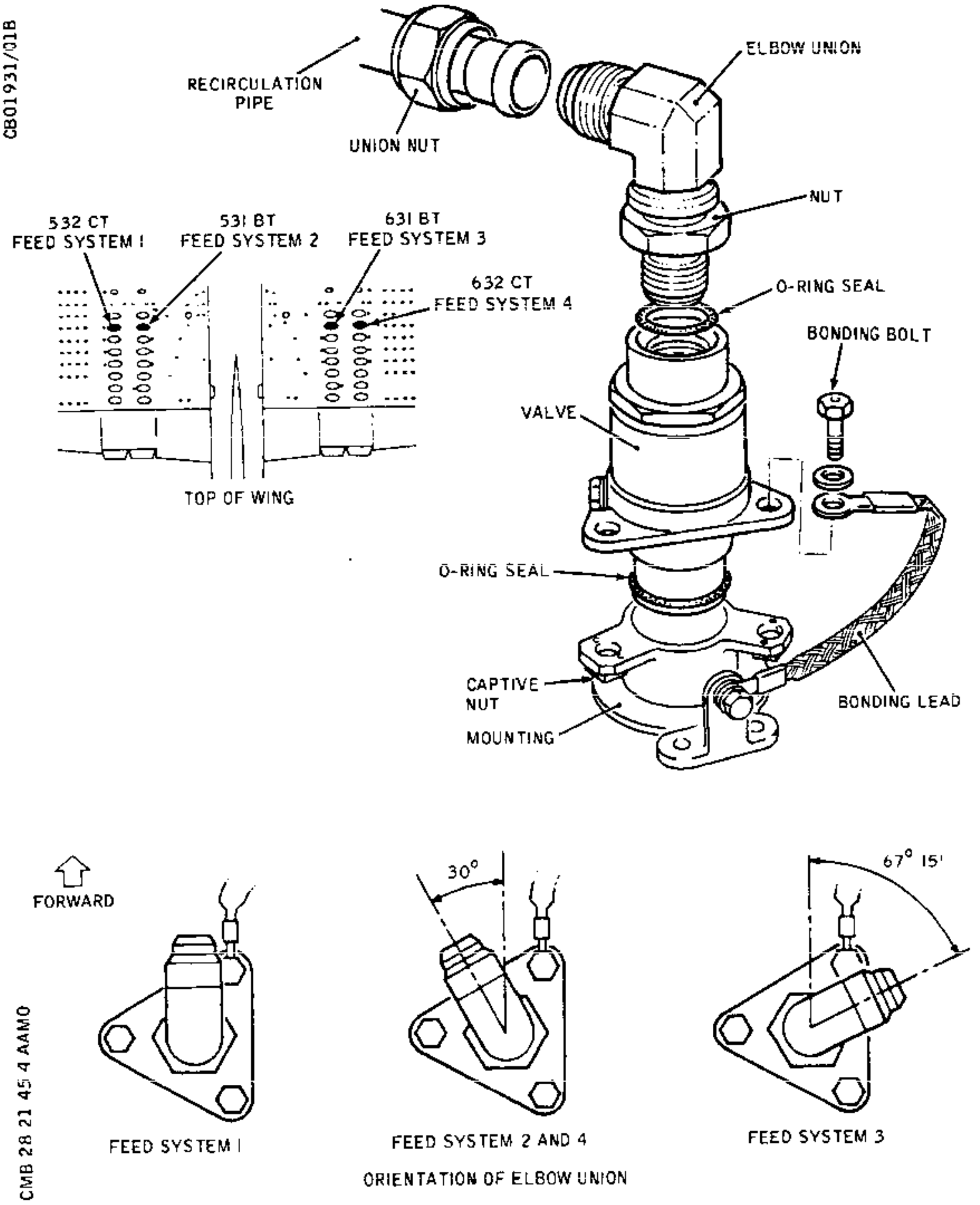
SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 LP VALVE SUP 1	15-216	1Q1	C1
ENG 1 LP VALVE SUP 2	16-215	1Q2	-
ENG 2 LP VALVE SUP 1	15-216	2Q1	F2
ENG 2 LP VALVE SUP 2	15-215	2Q2	C19
ENG 3 LP VALVE SUP 1	15-216	3Q1	F1
ENG 3 LP VALVE SUP 2	15-215	3Q2	C20
ENG 4 LP VALVE SUP 1	15-216	4Q1	C2
ENG 4 LP VALVE SUP 2	16-215	4Q2	-

(5) Using the key, remove the appropriate access panel from the wing top surface (Ref. Fig. 401).

(6) Using the drain equipment, drain the fuel from engine feed pipeline (Ref. 28-21-00, Servicing).

C. Remove

(1) To assist disconnection of the recirculation pipe, remove sufficient pipe support clips from the associated pipe. During removal, note the positions of the clips; retain the clips with their bolts and washers and, where applicable,



- Recirculation Non-return Valve - Installation
R
Figure 401

the bonding strips.

(2) Disconnect the recirculation pipe from the elbow union at the valve.

NOTE: There will be a loss of residual fuel from the pipe when disconnected; fit a suitable blank to the pipe end immediately.

(3) Remove the three bolts and washers securing the valve and bonding lead, and withdraw the valve from the mounting.

(4) Slacken the nut, and unscrew and remove the elbow union from the valve.

(5) Remove and discard the O-ring seals.

(6) Fit suitable blanks to the pipes and valve.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the pipes and valve.

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the valve.

(4) Insert the valve into the mounting and secure it with the three bolts and washers, fitting the bonding lead beneath the head of the bonding bolt; torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(5) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the elbow union.

(6) Fit the elbow union and nut to the valve; correctly orientate the union and secure it with the nut as shown in 28-22-12, Fig.403, Sensing Pipe - Adapter Installation; torque-tighten the nut to between 445 and 455 lbf in (5.028 and 5.141 mdaN).

(7) Connect the recirculation pipe to the elbow union; torque-tighten the union nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(8) Refit, in the positions noted during removal, the pipe support clips on the recirculation pipe; torque-

R tighten the bolts to between 35 and 44 lbf in (0.395
R and 0.497 mdaN).

R (9) Where applicable, check that the electrical
R bonding of the pipe to the clip and structure, and
R component to structure, is in accordance with
R 20-27-11.

R E. Conclusion

R (1) Set the LP VALVE switch to "OPEN".

R (2) Reset the circuit breakers previously tripped.

R (3) Remove the warning placard.

R (4) Carry out a Functional Test of the valve (Ref.
R Adjustment/Test).

R (5) Carry out a Leakage Test of the recirculation pipe
R as detailed in 28-21-00, Adjustment/Test, and check
R the disturbed joints.

R (6) Fit and secure the access panel, using the key.

RECIRCULATION NON-RETURN VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises a Functional Test and a Leakage Test of the non-return valve. The Functional Test proves the valve against reverse fuel flow and checks the flow through the valve.

Operational and System Tests are not applicable.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Ground fuel pressure test rig	-
Recirculation pipe adapter, to connect recirculation pipe to test rig supply line	E925111000
Container, capacity 1.75 pints (1.0 l), to collect fuel spillage	-
Key, for wing access panel	E920132000

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that the associated collector tank is between 25 and 75 per cent full. Refuel if necessary (Ref. 12-11-28).

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Electrically isolate the associated engine

R recirculation valve by tripping the appropriate
R circuit breaker; fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
ENG 1 FUEL RECIRC VALVE CONT	3-213	1Q791	G1
ENG 2 FUEL RECIRC VALVE CONT	1-213	2Q791	E5
ENG 3 FUEL RECIRC VALVE CONT	1-213	3Q791	E6
ENG 4 FUEL RECIRC VALVE CONT	3-213	4Q791	G2

R (5) Disconnect the recirculation pipe from the engine (Ref. 28-21-00, Adjustment/Test).

R NOTE: There will be a small loss of fuel from the pipe when it is disconnected. A suitable container should be positioned to collect this fuel. There will be no loss of fuel from the engine side because the engine recirculation valve will be closed.

R (6) Unlock and remove the appropriate wing access panel (Ref. Removal/Installation), using the key.

R C. Test

R (1) Prove the valve against reverse flow as follows:-

R (a) Set the ENGINE FEED PUMPS switches for the associated collector tank to "ON".

R (b) Check that no fuel flow in excess of 8 drops per minute occurs from the recirculation pipe end.

R (c) Set the ENGINE FEED PUMPS switches to "OFF".

R (2) Prove the rate of fuel flow through the valve as follows:-

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R (a) Using the recirculation pipe adapter, connect the test rig to the recirculation pipe as detailed in 28-21-00, Adjustment/Test.

R (b) Operate the rig and gradually increase the pressure to 100 psig (6.895 bar); check, by reference to the fuel quantity indicator, that the quantity of fuel transferred to the associated tank, in a 5 min period, is greater than 110 kg for systems 2, 3 and 4, or 120 kg for system 1.

R (3) Check the valve joints in the dry bay for freedom from fuel leakage during operation (2).

R D. Conclusion

R (1) Release the rig pressure and disconnect the test rig and recirculation pipe adapter.

R (2) Reconnect the recirculation pipe to the engine (Ref. 28-21-00, Adjustment/Test).

R (3) Remove the safety clip and reset the circuit breaker previously tripped.

R (4) Carry out the Leakage Test for the engine feed and recirculation pipe (Ref. 28-21-00, Adjustment/Test) to check the joint between the recirculation pipe and the engine.

R (5) Refit the wing access panel, using the key.

R (6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 3. Leakage Test

R A. Test

R (1) Check the valve joints for leakage by carrying out the Leakage Test for the recirculation pipe as detailed in 28-21-00, Adjustment/Test.

MAIN TRANSFER SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001, 002 and 003)

The function of this system is to replenish the collector tanks as their fuel is withdrawn by the engine feed system and to maintain the centre of gravity (c.g.) of the main tanks fuel at the optimum position during supersonic cruise.

The left and the right main tank groups each have self-contained systems for transferring fuel from the main tanks to the collector tanks at a rate which will ensure that the collector tanks are either maintained in a near full condition, or the rear tanks near full and the forward tanks controlled at a lower level, to finally trim the aircraft for cruise as the fuel is being consumed. The collector tanks are replenished from the main transfer tanks (5, 6, 7 and 8) in a sequence which minimizes the movement of the aircraft centre of gravity. The c.g. is controlled by drawing fuel from a main tank on the left side simultaneously with a main tank which has an equal but opposite pitching moment on the right side.

Fuel from the outer wing tanks 5A and 7A is not pumped directly to the collector tanks, but is first transferred to the associated main tanks 5 and 7. Also, main tanks 5 and 7 receive a certain quantity of fuel from the trim transfer tanks during a trim transfer operation (Ref. 28-23-00).

Each main transfer tank is equipped with two electric motor-driven pumps, separately controlled and fed from a.c. busbars. All pumps, except those in the outer wings, are inside the tanks, either in the wing or fuselage cells, and contained in isolation canisters enabling them to be removed without prior draining of the tank. Each pump delivers fuel through a single transfer pipe to a collector tank. The outer wing tanks have two pumps each; they are mounted in pairs outside and below the tanks and each pair delivers fuel through a single pipe to the associated main tank. Pressure switches give warning of low pressure at all the pump outlets.

Except for the transfer pipes connecting tanks 5A and 7A to tanks 5 and 7, where flow is controlled by transfer shut-off valves in the pipes, the flow of fuel in each transfer pipe is regulated or stopped by a transfer control valve, controlled by a float-operated sensor valve in the tank receiving the transferred fuel. Each sensor valve is positioned at a different fuel level, causing the control valves to operate separately and in a sequence corresponding to the differing vertical position of the sensor floats. This arrangement

automatically ensures that the collector tanks are maintained at full level until all the main tanks are emptied, and that the change-over from one main tank to the next in supplying
R the collector tanks is positive, and in the correct sequence
R for c.g. control, thus:-

	LEFT	RIGHT
R	Tank 5 (forward).....	Tank 7 (rear)
R	Tank 6 (rear)........	Tank 8 (forward)

To enable the fuel level in the forward collector tanks to be controlled at a reduced level, solenoid valves are connected in tanks 1 and 4 transfer control valve sensor sense
R pipes. These solenoid valves stop the fuel flow to the upper control sensors when it is required to control the tank contents at the reduced level.

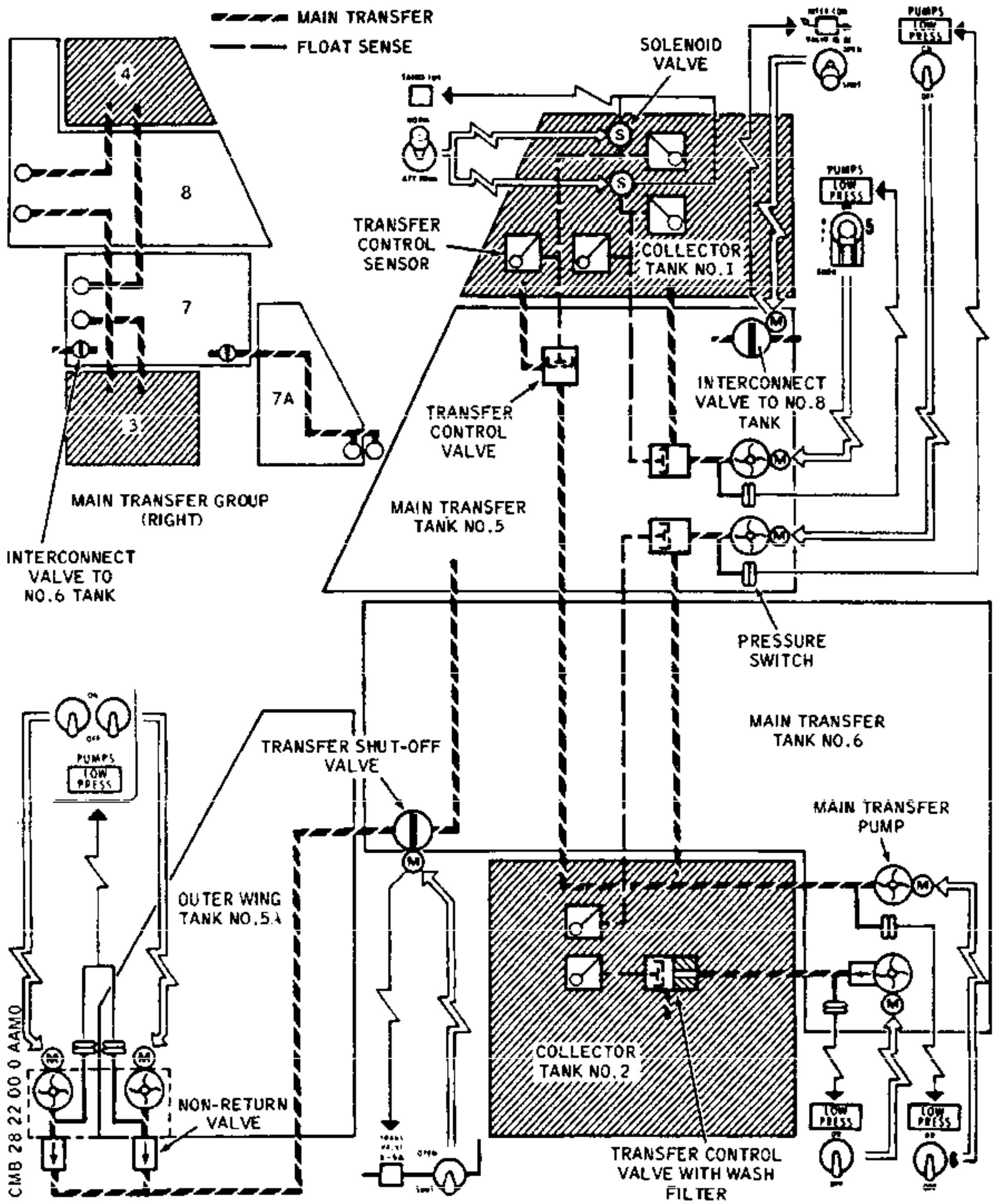
Electrically operated interconnect valves permit fuel to be transferred under gravity between a main tank on one side to another on the opposite side from which the fuel may be pumped to the collector tanks. This safeguards against the inability
R to transfer fuel from a main tank should both its pumps fail.

The electric supplies and control are arranged to enable the transfer of fuel to continue with a single electrical power failure. The control switches and indicators for the transfer pumps and interconnect valves are laid out in a fuel flow form on the fuel system management panel at the third crew member's station.

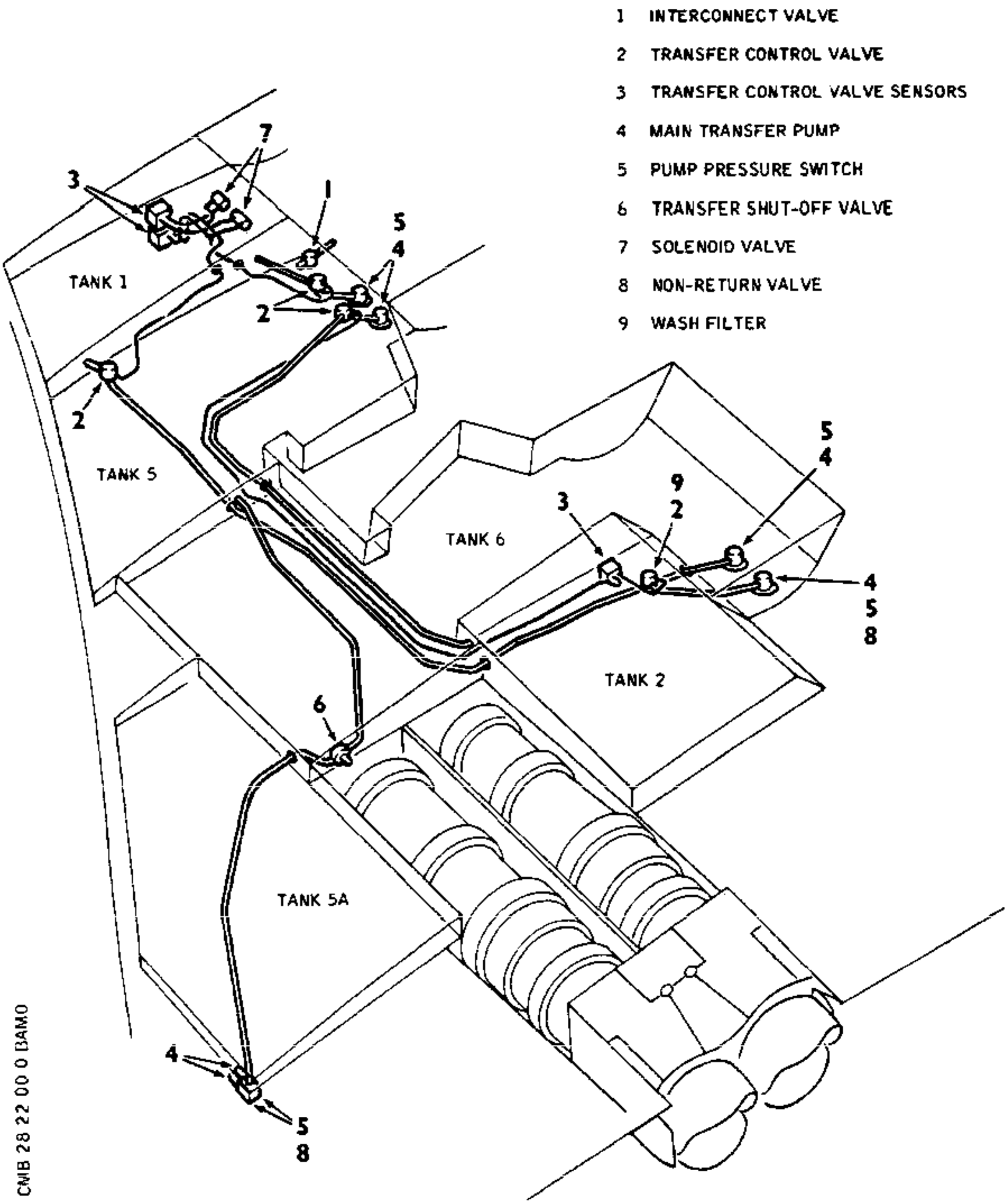
2. Pump Unit (Tanks 5, 6, 7 and 8)

There are two of these pumps installed in each tank, those
R for tanks 6 and 8 being located in the fuselage cells. All the
R pumps are similar, each comprising an electric motor-driven, low pressure centrifugal pump element, projecting vertically from the floor of the tank up into a canister. The canister isolates the pumps from the fuel in the tank enabling removal of the pump element without prior draining of the tank. The
R electric motors use 200 V three-phase a.c. power, and are controlled by separate switches on the fuel management panel.

The pump element is identical to the engine feed pump element described in 28-21-00. The canister is also similar to the engine feed pump canister except that only one pump in tank 6 and one pump in tank 8 have non-return valves at the pump
R outlet, to prevent fuel spillage, via the de-aeration nozzles,
R when a pump element is removed.



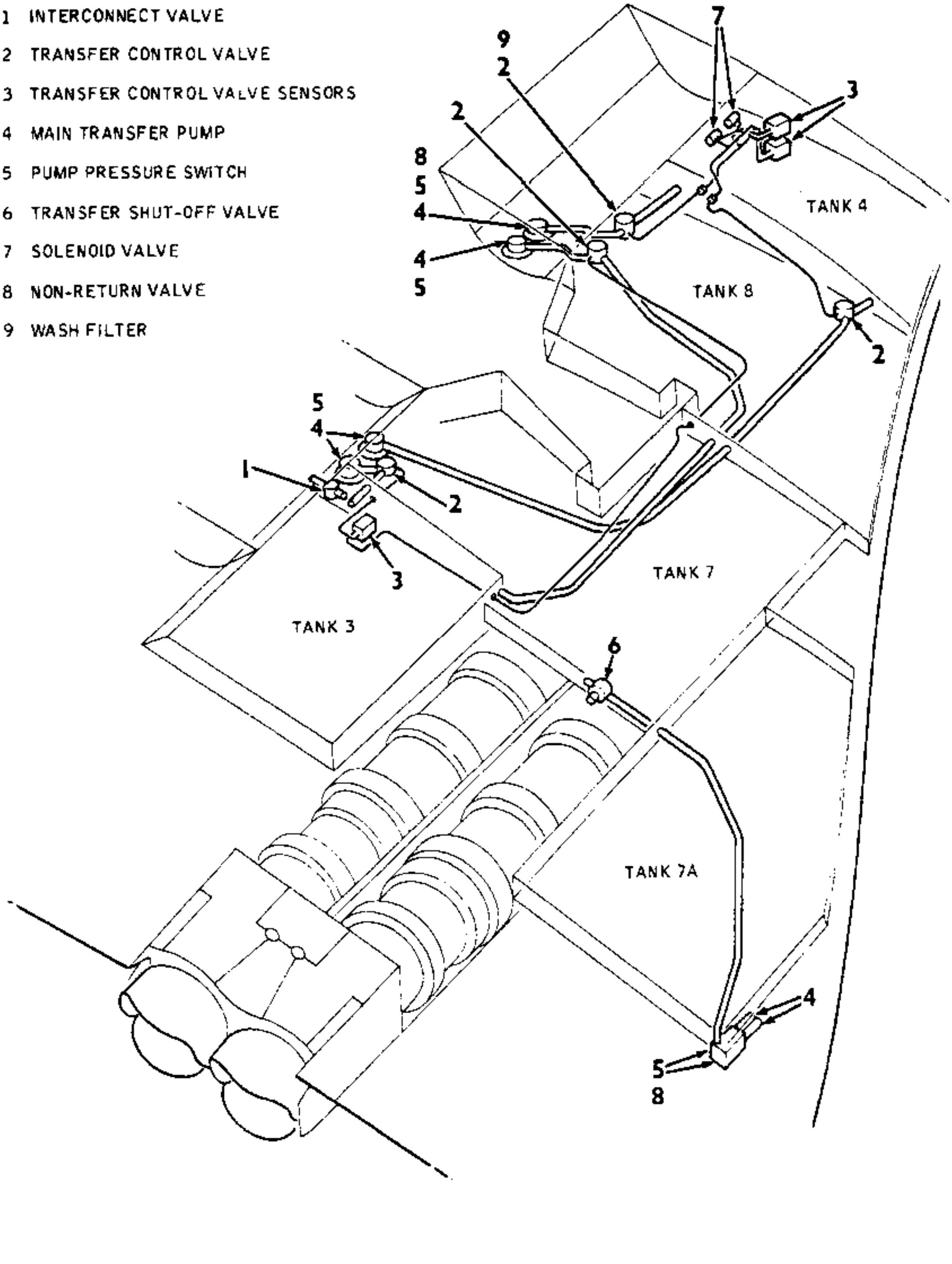
Main Transfer Schematic
Figure 001



- Main Transfer System (Left) - Component Location
Figure 002

CB01111/01B

1 INTERCONNECT VALVE
2 TRANSFER CONTROL VALVE
3 TRANSFER CONTROL VALVE SENSORS
4 MAIN TRANSFER PUMP
5 PUMP PRESSURE SWITCH
6 TRANSFER SHUT-OFF VALVE
7 SOLENOID VALVE
8 NON-RETURN VALVE
9 WASH FILTER



CMB 28 22 00 0 CAMO

\- Main Transfer System (Right) - Component Location
Figure 003

R

3. Pump Unit (Tanks 5A and 7A) (Ref. Fig. 004)

These pumps are installed horizontally in pairs; they are bolted to separate mounting plates which are bolted and sealed to the outside of a fuel sump outboard of each outer wing tank. A pump may be removed from its mounting without prior draining of the tank.

Each pump of a pair delivers fuel into an outlet pipe joined to the mounting plate and extending through the sump to a non-return valve housed in a manifold common to both pumps. From the manifold, the fuel flows through a single transfer
R pipe and a transfer control valve to a main tank.

The fuel inlet and outlet ports in the pump casing terminate in spigots to engage with ports in the mounting plate. Similarly, a spigot on the mounting plate engages with the pump vent outlet. The inlet port spigot projects through the mounting plate to hold open a flap valve. Another flap valve at the vent port is held open only by fuel flow. When the pump is being dismounted, both flap valves remain closed under spring pressure to isolate the fuel in the sump. A drain plug enables the pump casing to be drained prior to pump removal.

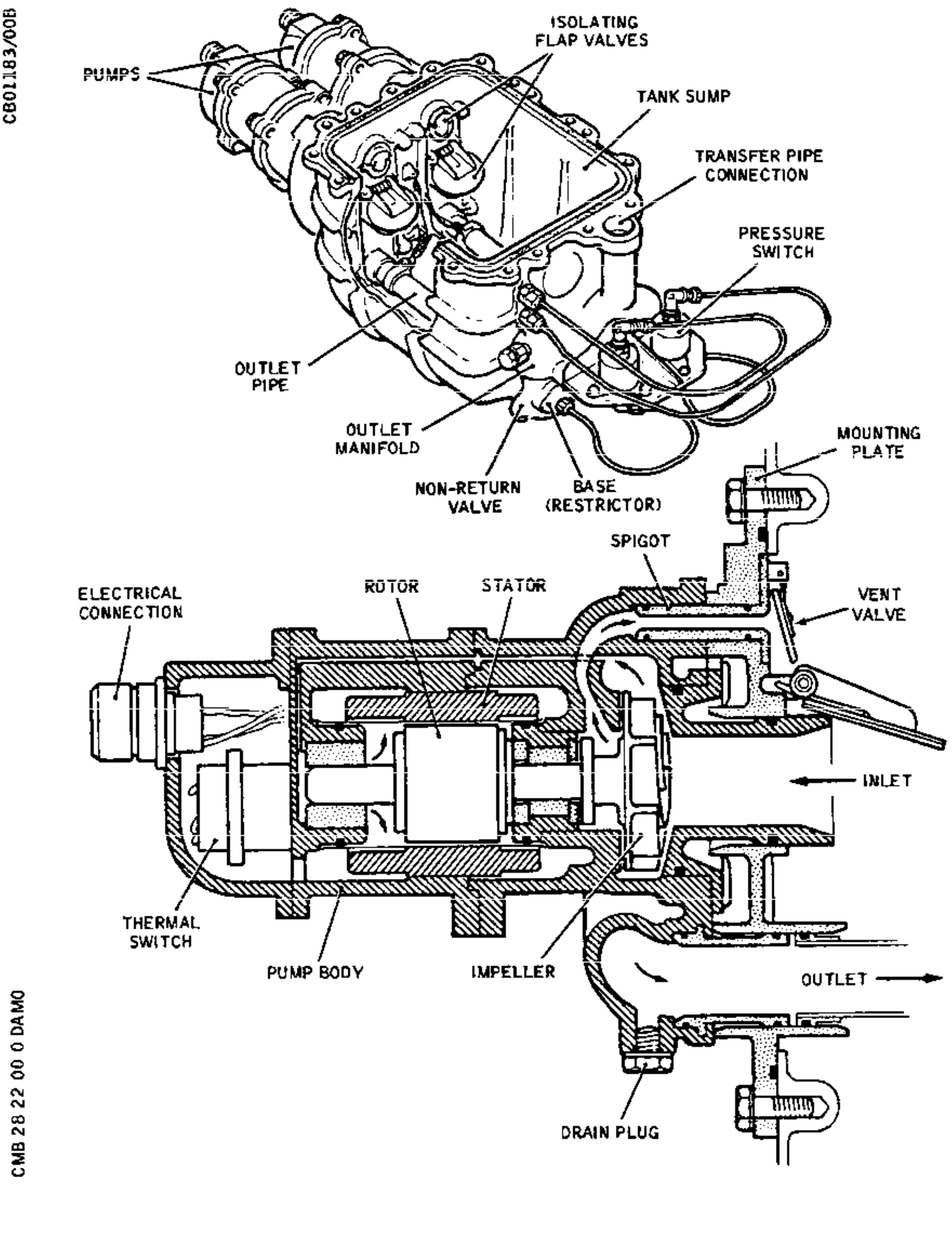
The pump element is a low pressure centrifugal type, driven by an electric motor using 200 V three-phase a.c. power, controlled by a separate switch. Some of the fuel being pumped is circulated through the pump casing and bearings to serve as a coolant and lubricant for the motor. The circulated fuel, together with any fuel vapour produced by the impeller, is vented back into the fuel sump.

Should the motor be operating for a period under dry conditions, a thermal switch protects the motor from overheating by switching it off, or on, within a pre-set temperature range. A thermal fuse prevents the pump from causing a hazard due to overheat. If the fuse fails, a new stator must be fitted.

4. Interconnect Valve

There is one of these valves in tank 5 and one in tank 7. They are connected in short pipes leading to the fuselage cells of tanks 8 and 6 respectively. With a valve open, fuel will flow under gravity and enable the majority of the fuel in the interconnected tanks to be transferred from one of the tanks in the event of double pump failure in the other.

The valve is of the spherical plug type, contained in an isolation canister bolted to the tank floor. Transit of the



- Pump Unit (Tanks 5A and 7A)
R Figure 004

valve is effected by a 28 V d.c. electric motor with its control switch and magnetic indicator located on the fuel management panel. The description of the valve unit is identical with that given for the cross-feed valve in 28-21-00.

5. Non-return Valve (Tanks 5A and 7A) (Ref. Fig. 005)

Each of the four outer wing tank pumps has a removable non-return valve fitted in the outlet manifolds on the tank sump. The valve prevents any reverse flow occurring when the associated pump is inoperative. The valve assembly consists of a tubular body, with an annular seat, and a spring-loaded flap valve.

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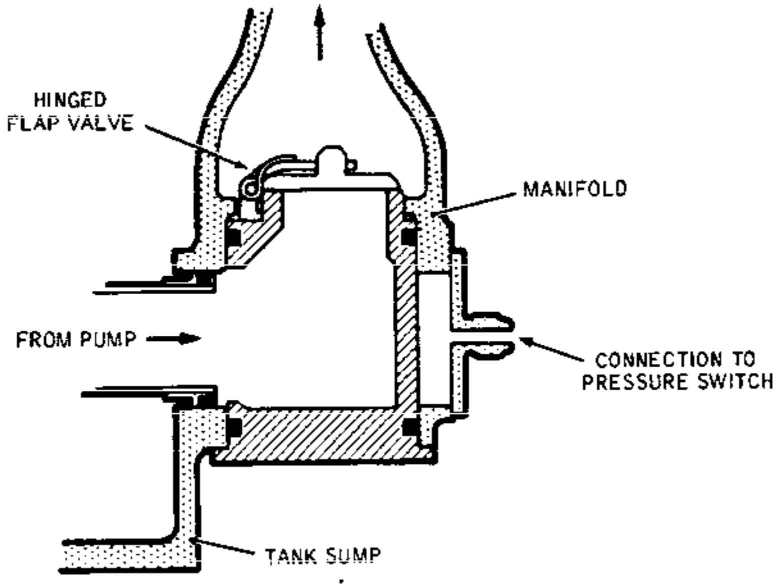


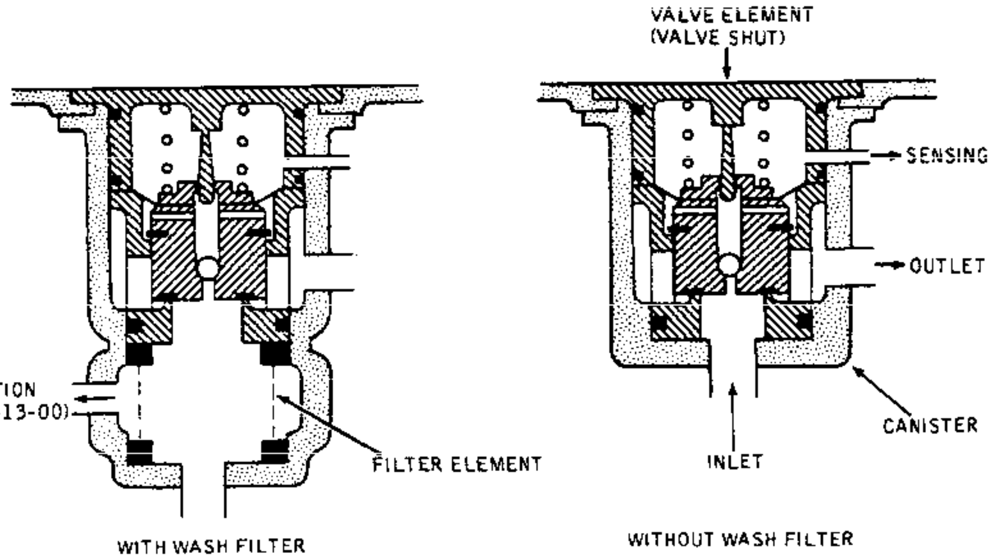
CMB 28 22 00 0 EAM0

Non-return Valve
Figure 005

R 6. Transfer Control Valve and Sensor (Ref. Fig.006 and 007)
R (Ref. Fig.008 and 009)

The float-operated sensor valve controls a transfer control valve and these valves together control the transfer of fuel from one tank to another. The control valve is connected in the transfer pipe and it regulates or stops the fuel flow.

CB15873/00A

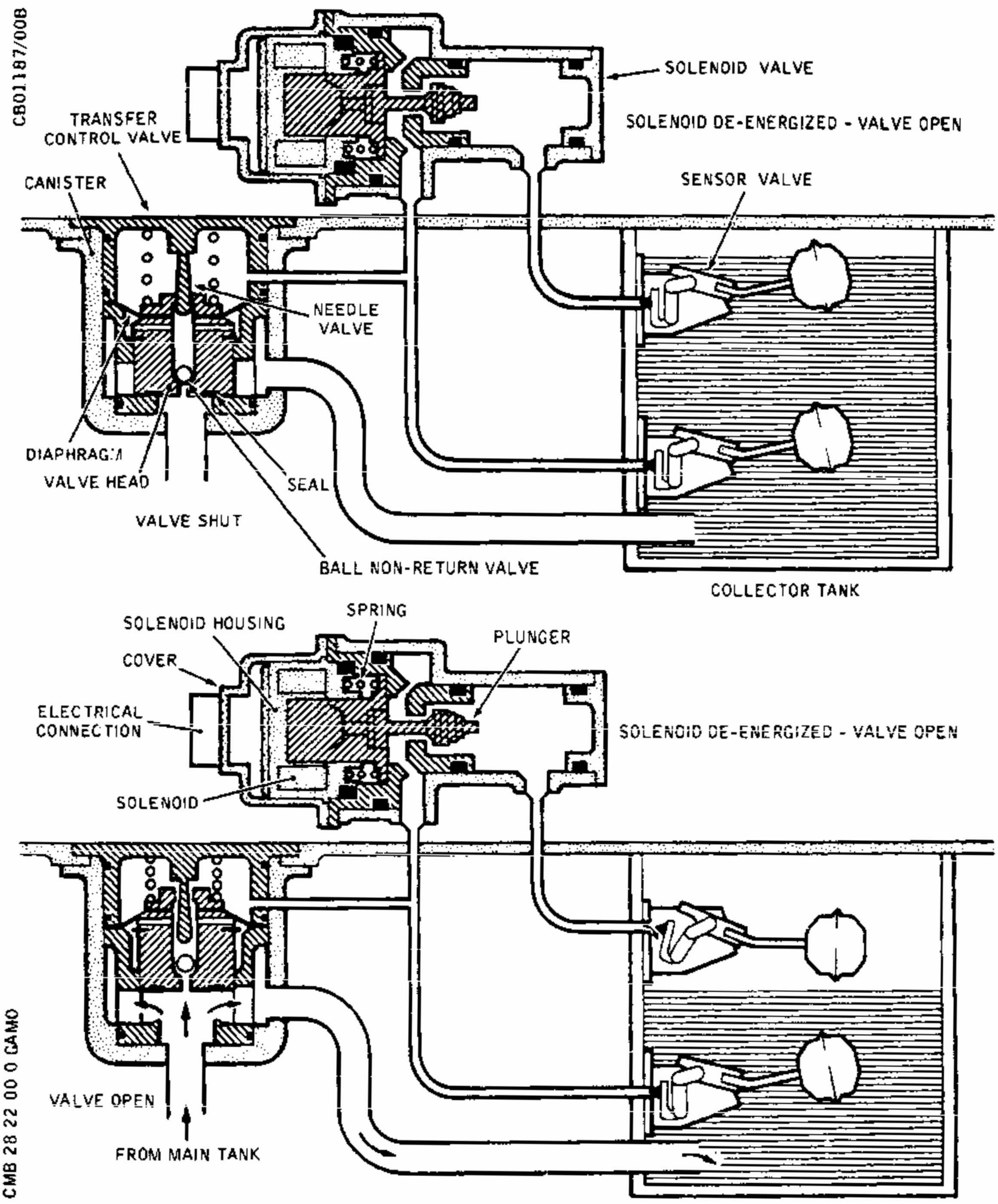


CMB 28 22 00 0 FAMO

Transfer Control Valves
R Figure 006

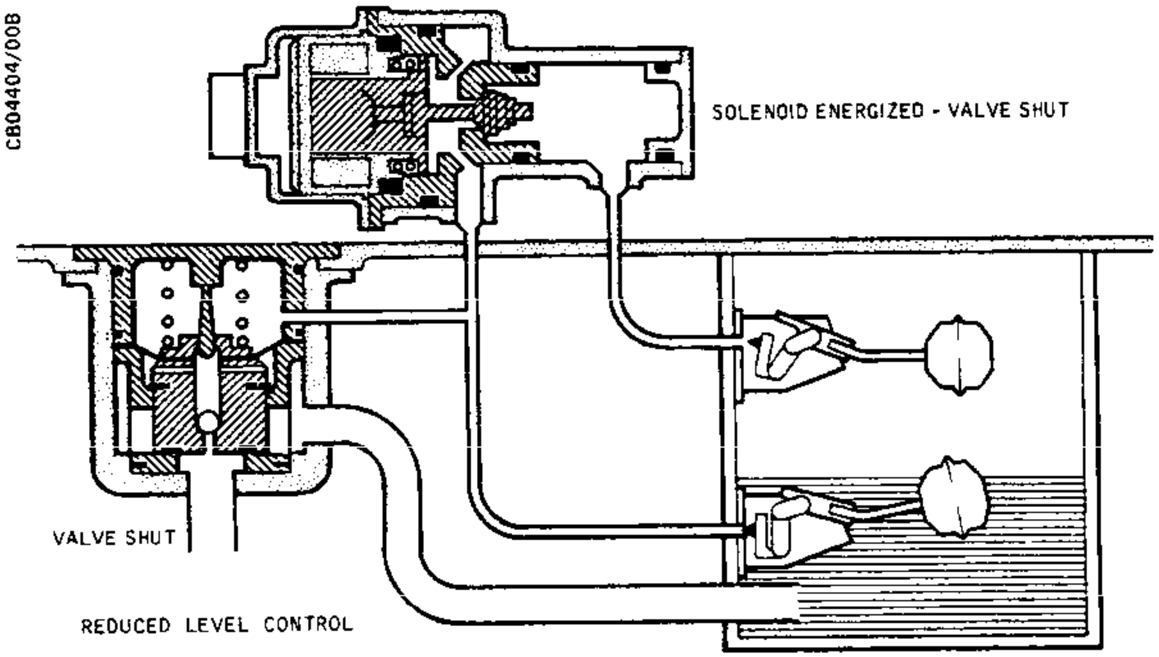
The sensor is in the tank receiving the fuel and controls the flow of fuel from the outlet of a small bore sensing line connected to a chamber in the control valve. Some control
R valve canisters are fitted with wash filters to protect the de-aeration nozzles.

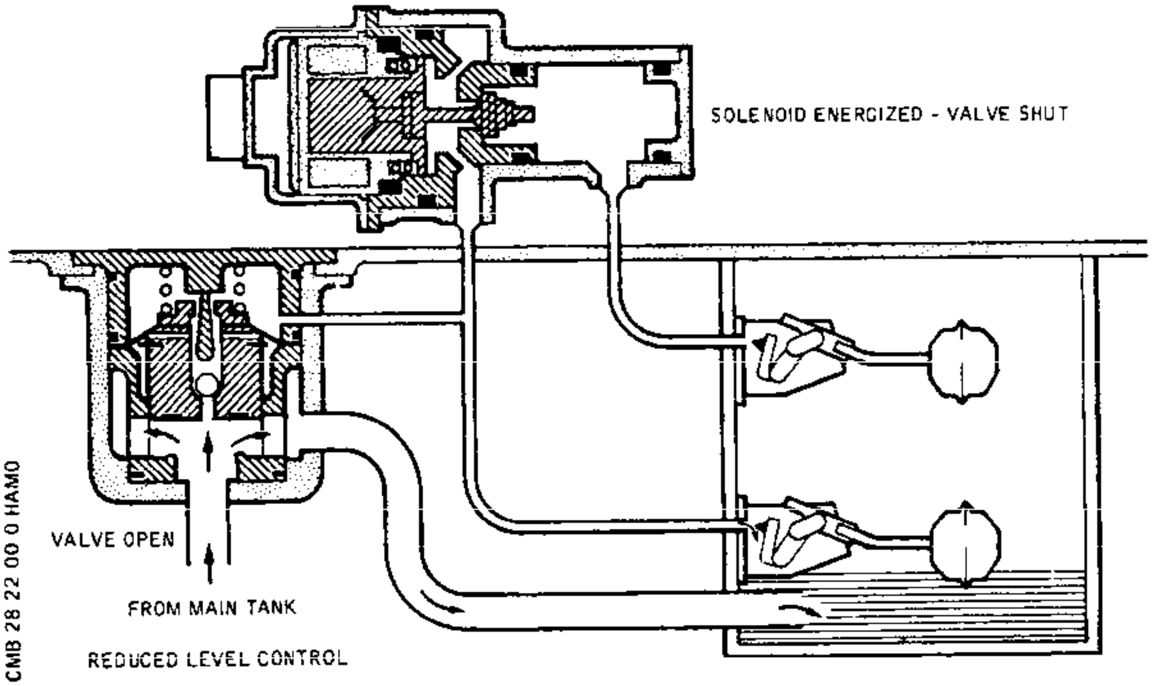
The transfer control valve comprises a valve canister bearing the fuel connections; it is attached to the roof of a tank and contains a removable valve assembly which fits flush with the wing surface. The valve assembly has an upper and a lower chamber separated from each other by a flexible diaphragm. A spring-loaded valve head is secured to the centre of the diaphragm which permits it to move vertically in the lower chamber. The valve head controls the entry of fuel from the pump through a port in the base of the chamber, and its exit through a port connected to the transfer pipe. Sensing ducts and a needle valve are incorporated in the valve element components to regulate fuel flow, control and closure characteristics. A ball-type non-return valve is fitted in the valve head to positively seal the sensing orifice when the valve is closed.



\- Main Transfer Control Valve, Sensor and Solenoid Valve (Valve Open)
Figure 007

R





\- Main Transfer Control Valve, Sensor and Solenoid Valve (Valve Shut)
Figure 008

R

R Before SB 28-039

R In each transfer control valve, fuel is bled into the
R lower chamber side of the diaphragm, to provide a pressure
R balance and lubrication for the piston. A top piston seal
R is provided to prevent fuel seepage when the valve is shut.

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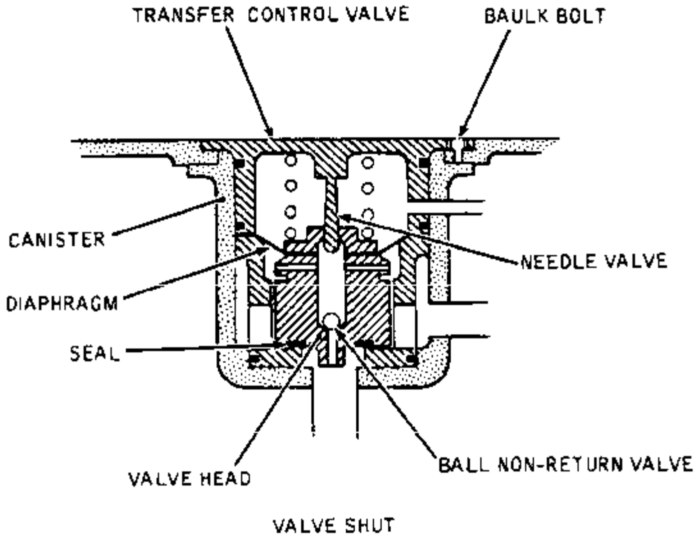


CMB 28 22 00 0 JAMO

- Transfer Control Valves - Tanks 5 and 8 (Outboard)
After Service Bulletin 28-039
R Figure 009

R After SB 28-039 For A/C 001-005,

R Surge pressures generated in the system are reduced by
R introducing leakage paths in the outboard transfer control
R valves of tanks 5 and 8. By omitting the top piston seal
R and fitting a smaller piston, fuel is allowed to leak from
R the inlet to the outlet around the piston. A cut-out on
R the valve flange and a baulk bolt on the aircraft ensure
R that the correct type of valve is fitted.

The sensor is a needle valve operated by a float and linkage

mechanism with stops to limit float movement. The valve body and float mechanism are contained in open-ended support boxes attached to structure in the collector tanks. The sensors are fitted in pairs in each support box. There are four upper support boxes, one inside each collector tank at high level, and two additional support boxes, one in each of tanks 1 and 4, mounted at a reduced level. The two sensors in each support box are mounted at different levels to provide the correct transfer sequence. When reduced level control is required in tanks 1 and 4, a control switch on the fuel management panel is set to close solenoid valves which stop the fuel flow to the sensors in the upper support boxes of these tanks.

With the sensor needle valve open, pressurized fuel from the pump is able to lift the transfer control valve head off its seat against the spring pressure, permitting fuel to flow into the transfer pipe and also through the valve head sensing ducts into the upper chamber, sensing line and tank. When the rising fuel level in the tank begins to close the sensor needle valve, pressure builds up in the transfer control valve upper chamber, causing the diaphragm, assisted by the spring, to deflect downward and the valve head to progressively close the fuel ports in the lower chamber.

R Fuel passing through a valve via a wash filter is diverted
R through the filter, for de-aeration purposes, when the
R valve is shut (Ref. 28-13-00).

The transfer control valve also functions as a non-return valve to prevent fuel flowing from the collector tank back to the transfer tank.

R 7. Solenoid Valve (Ref. Fig.007 and 008)

R The solenoid valves, which stop the fuel flow to the high level sensors when reduced level control is required for tanks 1 and 4, are mounted in the over-wing fillets, above tanks 1 and 4.

The valve is a simple plunger-type valve, the plunger, normally in the valve-open position, being pulled against a spring when the solenoid is energized to close the valve. The solenoid is fitted in a housing and the complete valve assembly is enclosed by a cover, which is in halves, bolted together. The fuel inlet and outlet connections are contained in one half of the cover. O-ring seals ensure that fuel does not pass into the solenoid chamber.

8. Transfer Shut-off Valve

These valves, one in the main transfer pipe connecting tanks 5A and 5 and one in the pipe connecting tanks 7A and 7, are

identical to the refuel tank inlet valve (without non-return valve) described in 28-24-11 and are functionally similar to the interconnect valves.

R R R Each valve is used to control the fuel level in a main tank, and also to effect de-aeration of fuel in an outer wing tank.

9. Pump Pressure Switch (Ref. Fig. 004)

A pressure switch, near each transfer pump, gives a warning of low pressure output from the pump by initiating illumination of a caption on the fuel management panel. The switches for the outer wing tank pumps are mounted on brackets fixed to the tank sumps. The remainder are located outside and adjoining the tanks where the pumps are installed.

Restrictors are fitted in the unions of the pressure switch sensing pipes to limit the rate of fuel leakage in the event of pipe failure or pressure switch removal.

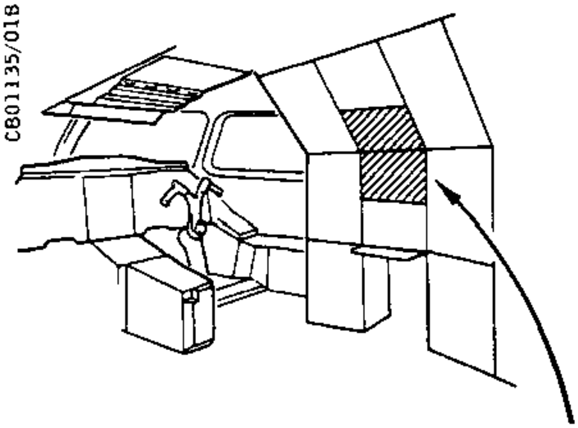
All the pressure switches are identical to those used for the engine feed pumps (Ref. 28-21-00).

10. Operation

A. Control and Indication

The controls and indicators for the main transfer system are all located in flow form on the left and right sides of the fuel management panels at the third crew member's
R station (Ref. Fig. 010). The captions are illuminated to show the low pressure condition of the pumps and the magnetic indicators display valve position.

Each main transfer pump and associated indication is separately controlled by an ON - OFF switch, with the exception of tank 5 - 1 pump and tank 7 - 3 pump
R (Ref. Fig. 011). Each of these pumps is separately controlled by a guarded switch with ON, OFF and EMER positions. The EMER position energizes the fuel transfer and automatically switches off the first standby engine feed pump in tanks 2 and 4 (Ref. 28-21-00). This pump isolation assists to prevent overloading the emergency generator if there is a four-engine failure. With a pump switch at ON the associated LOW PRESS caption is illuminated yellow momentarily until fuel pressure opens the pressure switch contacts. If the pump pressure falls to 2.5 psig (0.172 bar) above tank fuel pressure then the pressure switch contacts close and keep the caption illuminated until either the pump pressure rises or the



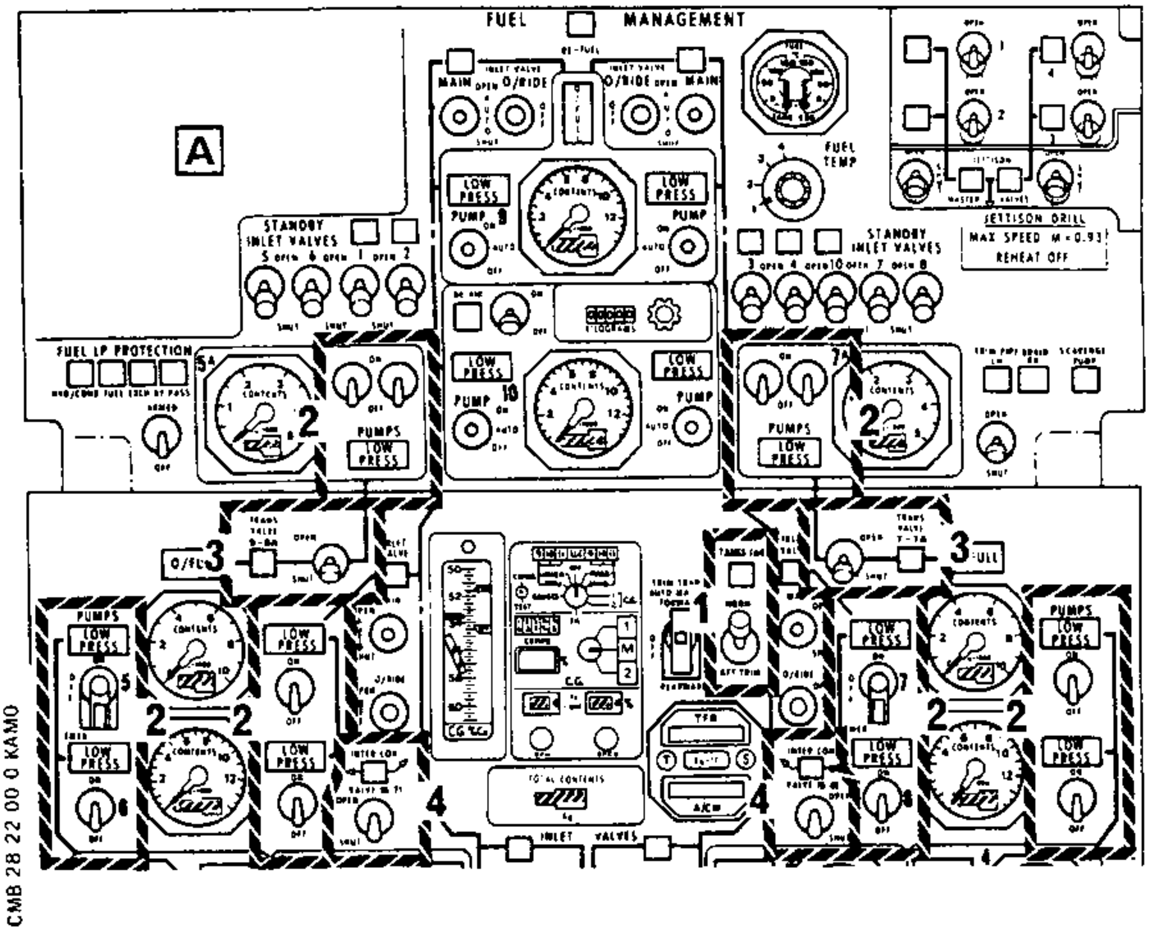
1 SOLENOID VALVE CONTROL SWITCH AND INDICATOR

2 MAIN TRANSFER PUMP CONTROL SWITCHES AND CAPTION LIGHTS

3 TRANSFER SHUT-OFF VALVE CONTROL SWITCH AND INDICATOR

4 INTERCONNECT VALVE CONTROL SWITCH AND INDICATOR

[A] AIR EXTRACTION (REF. 21-21-00)



– Main Transfer System - Controls and Indicators
Figure 010

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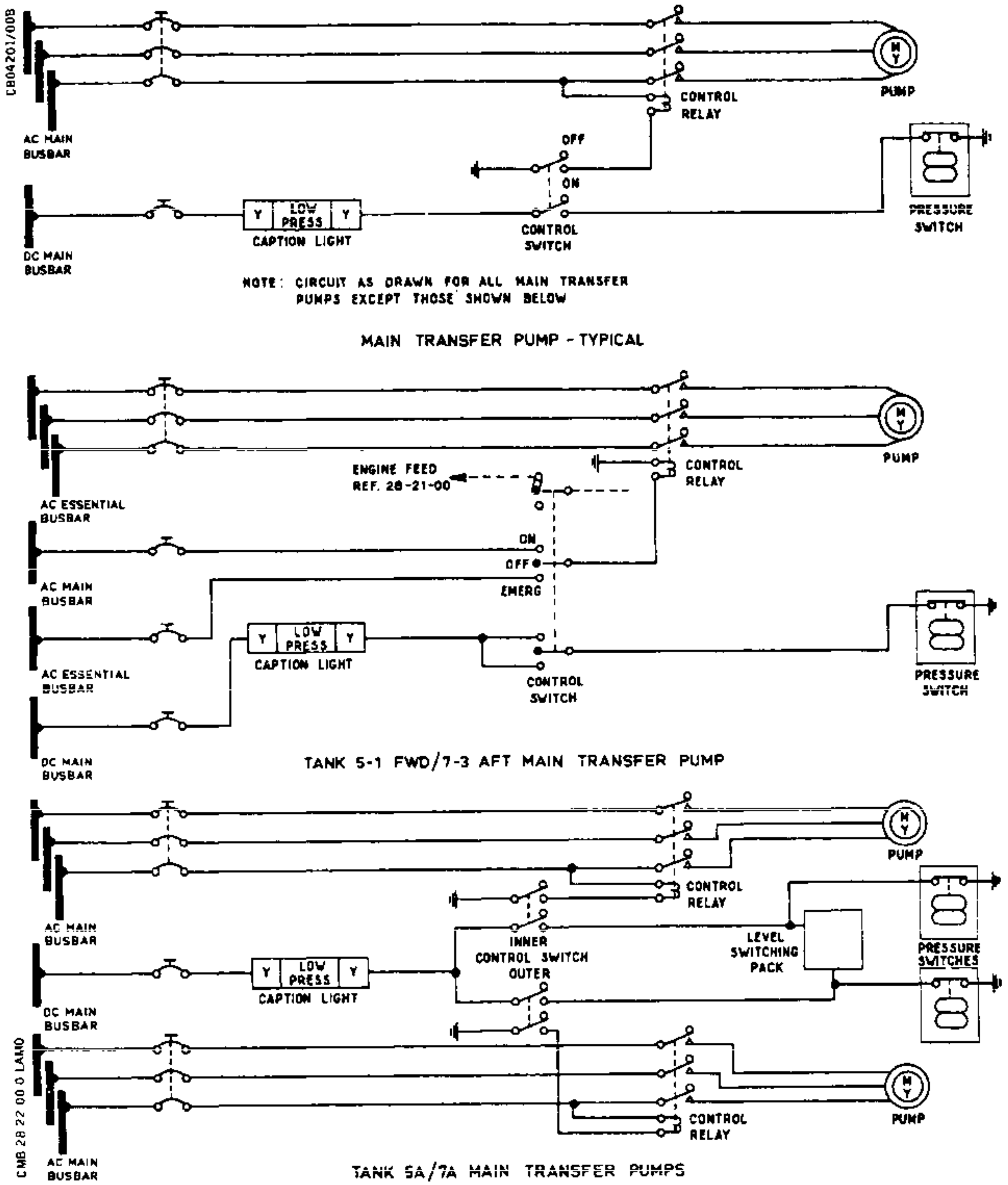
pump is switched off. With the pumps in tanks 5A and 7A either switched off or delivering low fuel pressure (one caption for the two pumps in tank 5A and one for the two pumps in tank 7A) the resultant closing of their pressure switch contacts automatically inhibits the tank overfull indication in tanks 5 and 7, provided that the trim and refuelling inlet valves in these tanks are shut. This inhibition prevents any false overfull indication that otherwise might occur either with sloshing or thermal expansion of the fuel when the tank is full.

The transfer shut-off valve for tank 5A - 5 is controlled manually by its OPEN - SHUT switch and automatically during fuel transfer by a high fuel level in tank 5. The switch toggle is locked in the SHUT position and must be pulled out against spring tension before it can be moved to the OPEN position. The automatic operation of the valve is inhibited when tank 5A pumps are switched off, to allow a pre-flight check to be made on the valve when tank 5 is fuelled to high level. A similar arrangement links the transfer shut-off valve for tanks 7A - 7 with the transfer pumps control of tank 7A. The magnetic indicator for each valve displays bar-in-line and bar-across-line when a valve is open and shut respectively and diagonal stripes when the valve is in transit (Ref. Fig. 014).

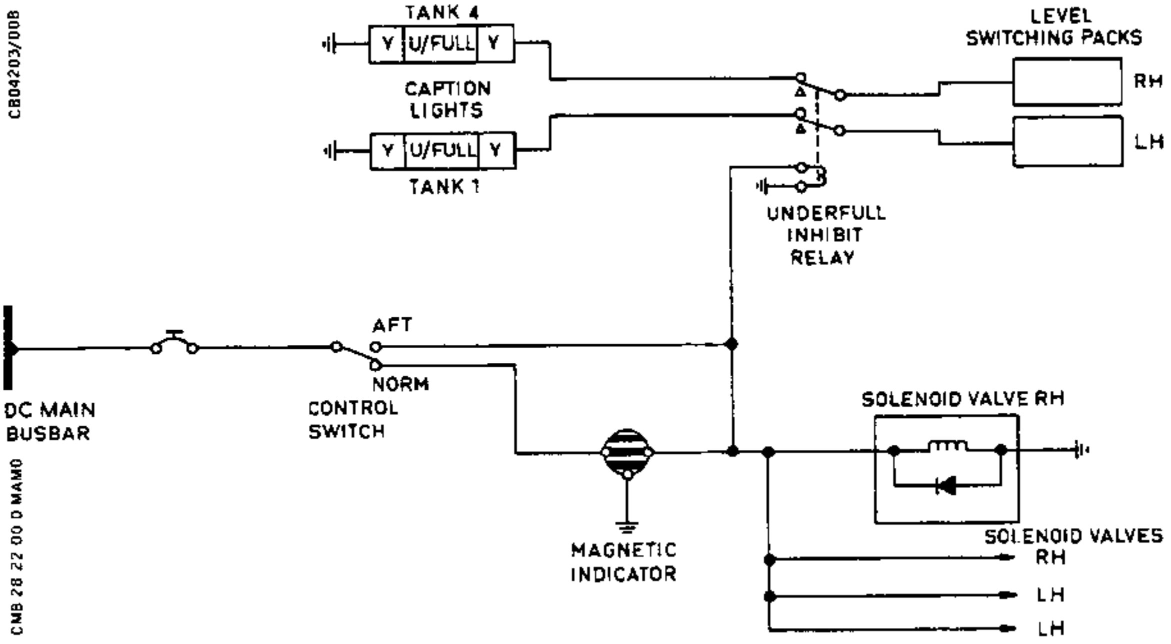
Each interconnect valve is separately controlled by an OPEN - SHUT switch (Ref. Fig. 010). The magnetic indicator for each valve displays OPEN and SHUT when a valve is open and shut respectively and diagonal stripes when the valve is in transit (Ref. Fig. 013).

The four main transfer control solenoid valves controlled by a NORM - AFT TRIM switch are de-energized to open with the switch in the locked, NORM position (Ref. Fig. 012). When required, control is effected at the reduced level control in the forward collector tanks by pulling the switch out against spring tension and setting it to the AFT TRIM position. This closes both solenoid valves associated with each collector tank, and the resultant increase in sense line pressure closes the transfer control valves, stopping fuel transfer into the tanks. The fuel level in these tanks falls until it reaches that corresponding to between 1,700 kg and 2,000 kg, at which point the fuel contents are maintained approximately constant by the reduced level control sensors. Return to normal level control is achieved by setting the switch to NORM to de-energize the solenoid valves to open. An associated three-position magnetic indicator shows NORM and AFT respectively



- Main Transfer Pumps - Control and Indication -
Simplified Schematic
Figure 011

and diagonal stripes when de-energized; NORM denotes that the solenoid is not energized but power is available on the circuit, AFT denotes that a positive supply is being provided and diagonal stripes indicate that power is not available. This positive supply also inhibits the underfull indications of tanks 1 and 4 which would otherwise be illuminated at the reduced level control. This inhibition is removed when the control switch is returned to the NORM position.



\- Solenoid Valve - Control and Indication -
Simplified Schematic
R Figure 012

Serviceability of all associated caption light filaments is checked by pressing the LIGHTS CTR push-switch on the electrical services panel, 6-214.

B. Functional Description

The arrangement of float-controlled main transfer valves gives an inherently automatic sequencing system in that if all the main transfer pumps were switched on at the start of flight, the transfer

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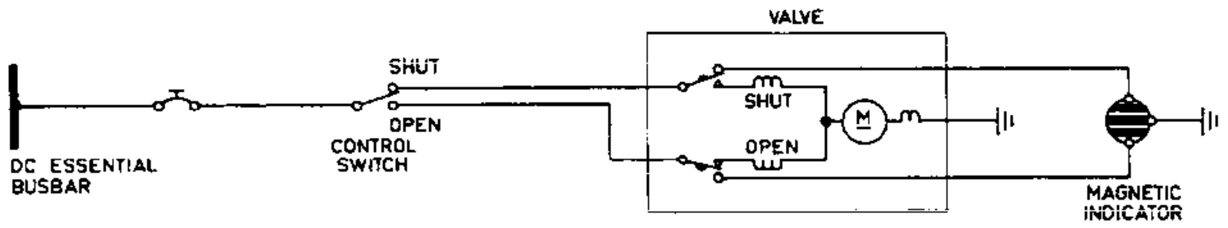

CMB 28 22 00 0 NAMO

- Interconnect Valve - Control and Indication -
Simplified Schematic
Figure 013

R

sequence would follow through automatically without fuel management during cruise flight. However, the indication on the fuel management panel enables the crew to monitor the sequenced transfer and correspondingly switch on, or off, individual pumps at loosely defined intervals within the transfer sequences in order to conserve pump life.

The outer wing tanks (5A and 7A) are auxiliary tanks forming, in effect, part of their associated main transfer tanks (5 and 7). Usage from the main tank groups in addition to maintaining a constant c.g. has also to ensure that no excessive loads are applied to the structure. For this reason the outer wing tanks are maintained full during the climb to provide wing bending moment relief. Early in the cruise stage the fuel levels in tanks 5 and 7 will fall and the transfer shut-off valves (5A-5) and (7A-7) are opened to allow transfer of fuel from the auxiliary main transfer tanks to their associated main transfer tanks.

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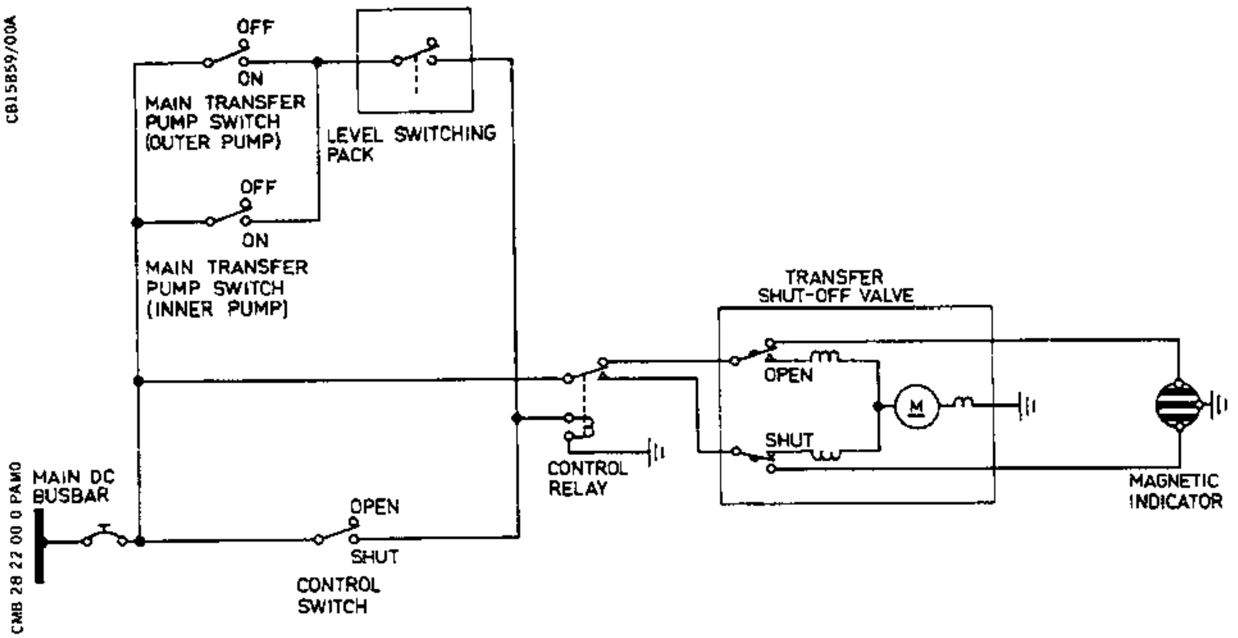

- Transfer Shut-off Valve - Control and Indication -
Simplified Schematic
R Figure 014

R A transfer shut-off valve is selected open using a control
R switch on the fuel mangement panel but, during fuel
R transfer, it is automatically closed if a high fuel level
is reached in its associated tank (5 or 7). High level
sensors in each of these tanks signal level switching packs
R to shut the valve in order to prevent the tank from being
R overfilled. In this condition, i.e., with one or two
R pumps operating and the valve shut, the pumped fuel is re-
R circulated within tank 5A or 7A via the de-aeration
R nozzles.

When the fuel level drops below the sensors, the valve
R is automatically re-opened and fuel transfer recommences.
R The automatic control of the valve is inhibited when the
associated outer wing tank pumps are switched off.

R The control switch on the fuel management panel is also
R used to select the valve shut for normal de-aeration
R purposes (Ref. 28-13-00).

Each main transfer pump is capable of supplying the

cruise flow to two engines, and 90 per cent of the maximum flow to one engine. There will be, therefore, only a small drop in collector tank level during the short periods of peak engine demands.

For normal conditions of main transfer the interconnect valves remain closed. If both transfer pumps in any main transfer tank fail, fuel transfer can be achieved by opening the associated interconnect valve and pumping from the adjacent tank.

11. Electrical Power Supplies

A. One transfer pump in tanks 5 and 7, and the interconnect valves, are supplied from the essential busbars. This arrangement allows the transfer system to continue operating if the four main a.c. generators fail. The remainder of the pumps are supplied from the main busbars. Details of supplies with circuit breaker location are given in Table 1.

SERVICE	BUSBAR	C/B PANEL
Main Transfer Pumps		
Tank 5 - 1	No.4 essential 200/115 V a.c.	4-213
	No.4 essential 115 V a.c. (emergency control)	4-213
	No.4 main 115 V a.c. (normal control)	14-216
Tank 5 - 2	No.2 main 200/115 V a.c.	13-215
Tank 6 - 1	No.1 main 200/115 V a.c.	14-215
Tank 6 - 2	No.3 main 200/115 V a.c.	13-216
Tank 7 - 3	No.3 essential 200/115 V a.c.	4-213
	No.3 essential 115 V a.c. (emergency control)	4-213
	No.3 main 115 V a.c. (normal control)	13-216
Tank 7 - 4	No.1 main 200/115 V a.c.	14-215

	SERVICE	BUSBAR	C/B PANEL
	Main Transfer Pumps		
	Tank 8 - 3	No.2 main 200/115 V a.c.	13-215
	Tank 8 - 4	No.4 main 200/115 V a.c.	14-216
	Tank 5A, outer	No.1 main 200/115 V a.c.	14-215
	Tank 5A, inner	No.2 main 200/115 V a.c.	13-215
	Tank 7A, outer	No.4 main 200/115 V a.c.	14-216
	Tank 7A, inner	No.3 main 200/115 V a.c.	13-216
	Pressure switches		
R	5 - 2, 6 - 1, 7 - 4, 8 - 3 and 5A	'A' main 28 V d.c.	15-215
R	5 - 1, 6 - 2, 7 - 3, 8 - 4 and 7A	'B' main 28 V d.c.	15-216
	Tank Interconnect Valves		
R	Tank 5-8	'B' essential 28 V d.c.	3-213
R	Tank 6-7	'A' essential 28 V d.c.	1-213
	Main Transfer Control Solenoids		
R	Tanks 1 and 4	'B' main 28 V d.c.	15-216
	Transfer Shut-off Valves		
R	Tank 5A-5	'A' main 28 V d.c.	15-215
R	Tank 7A-7	'B' main 28 V d.c. -	15-216

Electrical Supplies
Table 1

MAIN TRANSFER SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4., 5., 6.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

Where circuits are similar and incorporate identical components, e.g., 'Transfer Pumps, Tanks 5, 6, 7 and 8', all references to the associated components listed in Table 101 are given, e.g., 'Renew Pressure Switch (56) to (67) as required'.

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-

B. Prepare

(1) Ensure that the fuel level in the tanks suits the requirements of the particular trouble shooting procedures.

(2) Ensure that circuit breakers (Ref. Table 101) are set.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Display warning placards at the fuel management panel (3CM station) and the refuel control panel to indicate that work is being carried out on the fuel system.

(5) When trouble shooting transfer control valves (Ref. para.6.), ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft is laterally level (0 deg roll) and longitudinally between level and 1 3/4 deg nose up (0 and + 1 3/4 deg pitch). Reposition the aircraft if necessary.

3. Trouble Shooting - Transfer Pumps

A. Prepare to trouble shoot (Ref. para.2.)
Ensure that fuel level in tank is not less than 20 per cent full.
At lower electrical services panel (6-214), press LIGHTS CTR switch to "TEST". Check that all main transfer pumps LOW PRESS captions are illuminated yellow.
Release switch. IF -

- OK — continue to B.
- NOT OK — Renew filament(s) in Low Pressure Captions (80) to (89), as required.

NOTE: The following paragraph applies to all pump control switches except the guarded LH switches for tank 5 and 7 pumps.

B. At 3CM station, panel 5-214, set pump control switch to "ON".
Check that pump is heard to run and LOW PRESS caption is illuminated and then extinguished within 3 s.
Set switch to "OFF"; check that pump is heard to stop running and LOW PRESS caption is not illuminated. IF -

- OK
- NOT OK —
  1. Pump runs, but LOW PRESS caption is not illuminated when pump switched ON - Chart 101.
  2. Pump runs, but LOW PRESS caption is not extinguished after 3 s when pump switched ON - renew Pressure Switch (56) to (67), as required. If fault not cleared, check pressure switch sense line and/or fuel pump filter screen for blockage.

3. Pump does not run and LOW PRESS caption remains illuminated when pump switched ON - Chart 102.

NOTE: The following paragraph applies to the LH Pump Control Switches (74) or (75) for tank 5 and 7 pumps.

C. At 3CM station, panel 5-214, disengage guard and set LH pump control switch to "ON".
Check that pump is heard to run and LOW PRESS caption is illuminated and then extinguished within 3 s.
Set switch to centre "OFF"; check that pump is heard to stop running and LOW PRESS caption is not illuminated.
Repeat test, setting pump control switch to "EMER". IF -

NOT OK --------

1. Pump runs, but LOW PRESS caption is not illuminated when pump switched ON - Chart 101.
2. Pump runs, but LOW PRESS caption is not extinguished after 3 s when pump switched ON - renew Pressure Switch (57) or (63). If fault not cleared, check pressure switch sense line and/or fuel pump filter screen for blockage.
3. Pump does not run and LOW PRESS caption remains illuminated when pump switched ON - Chart 103.
4. Pump runs, but LOW PRESS caption is not illuminated/extinguished when pump switched to EMER - check for continuity between terminals 5 and 6 at pump control switch. If NOT OK, renew Pump Control Switch (74) or (75).

5. Pump does not run and LOW PRESS caption remains illuminated when pump switched to EMER - Chart 104.

NOTE: For checking interaction between tank 5 and 7 LH pump control switches and tank 2 and 4 1st standby ENGINE FEED PUMPS, refer to 28-21-00, Trouble Shooting.

4. Trouble Shooting - Transfer Shut-off Valves

A. Prepare to trouble shoot (Ref. para.2.) At 3CM station, panel 5-214, check that TRANS VALVE 5A-5 (or 7A-7) control switch is set to SHUT; check that associated valve magnetic indicator displays bar-across-line. Set switch to "OPEN"; check that magnetic indicator display changes to diagonal stripes, and then to bar-in-line within 2 s. Check that mechanical indicator on the valve is at OPEN. Set switch to "SHUT"; check that magnetic indicator display changes to diagonal stripes, and then to bar-across-line, within 2 s. Check that mechanical indicator on the valve is at SHUT. IF -

OK

NOT OK

1. Valve does not open/shut when control switch operated - Chart 105.
2. Magnetic indicator faulty, with correct valve operation Chart 106.

```
                  |
                  |
B.*****************************************
  *Check that tank 5 (or 7) is full and   *
  *tank 5A (or 7A) is not less than 20 per*
  *cent full.                             *
  *Set TRANS VALVE 5A-5 (or 7A-7) control *
  *switch to "OPEN"; check that valve     *
  *magnetic indicator displays bar-in-line*
  *Set either LH or RH PUMPS control      *
  *switch for tank 5A (or 7A) to "ON".    *
  *Check that valve magnetic indicator    *
  *changes to diagonal stripes and then   *
  *to bar-across-line within 2 s.         *
  *Set PUMP control switch to "OFF"; check*
  *that valve magnetic indicator display  *
  *changes to diagonal stripes, and then  *
  *to bar-in-line within 2 s.             *
  *Set valve control switch to "SHUT". IF-*
  *****************************************
                       |
                       |                 ----------------------------------
                       |                |1. Transfer shut-off valve does   |
                   NOT OK--------|   not shut automatically when   |
                                        |   pump switched ON - Chart 107.  |
                                         ----------------------------------
```

5. Trouble Shooting - Interconnect Valves

```
A.*****************************************
  *Prepare to trouble shoot (Ref. para.2.)*
  *At 3CM station, panel 5-214, check that*
  *INTER-CON VALVE 6-7 (or 5-8) control   *
  *switch is set to SHUT; check that      *
  *associated valve magnetic indicator    *
  *displays SHUT.                         *
  *Set switch to "OPEN"; check that       *
  *magnetic indicator display changes to  *
  *diagonal stripes, and then to OPEN     *
  *within 2 s.  Check that mechanical     *
  *indicator on the valve is at OPEN.     *
  *Set switch to "SHUT"; check that       *
  *magnetic indicator display changes to  *
  *diagonal stripes, and then to SHUT     *
  *within 2 s. Check that mechanical      *
  *indicator on the valves is at SHUT. IF-*
  *****************************************
                 |
                 |              ----------------------------------
                 |             |1. Valve does not open/shut when |
                 NOT OK--------|   control switch operated -     |
                               |   Chart 108.                    |
                               |2. Magnetic indicator faulty with|
                               |   correct valve operation -     |
                               |   Chart 109.                    |
                                ----------------------------------
```

6. Trouble Shooting - Transfer Control Valves (NORM - AFT TRIM)

```
A.*****************************************
  *Ensure that tank 1 (or 4) contains not *
  *more than 1,500 kg of fuel.            *
  *Prepare to trouble shoot (Ref. para.2.)*
  *At 3CM station, panel 5-214, check that*
  *NORM - AFT TRIM control switch is set  *
  *to NORM; check that associated magnetic*
  *indicator displays NORM; check that    *
  *tank 1 (or 4) U/FULL caption is        *
  *illuminated.                           *
  *Set switch to "AFT TRIM"; check that   *
  *indicator display changes to AFT and   *
  *tanks 1 and 4 U/FULL captions are      *
  *extinguished.                          *
  *Set switch to "NORM"; check that       *
  *indicator display changes to NORM and  *
  *tank 1 (or 4) U/FULL caption is        *
  *illuminated.  IF -                     *
  *****************************************
             |    |
             |    |             ----------------------------------
             |    |            |1. Magnetic indicator faulty when |
             OK   NOT OK-------|   switch operated NORM - AFT TRIM|
             |                 |   - NORM - Chart 110.            |
             |                 |2. Tanks 1 and 4 U/FULL captions  |
             |                 |   not extinguished when switch   |
             |                 |   set to AFT TRIM - *renew       |
             |                 |   Underfull Inhibit Control      |
             |                 |   Relay (108).                   |
             |                 |   If fault not cleared, refer to |
             |                 |   28-42-00, Trouble Shooting.    |
             |                  ----------------------------------
             |
B.*****************************************
  *With electrical power off, check that  *
  *NORM - AFT TRIM Indicator (107)        *
  *displays diagonal stripes.  IF -       *
  *****************************************
             |    |
             |    |             ----------------------------------
             |    |            |1. *Renew NORM - AFT TRIM         |
             OK   NOT OK-------|   Indicator (107).               |
             |                  ----------------------------------
```

```
C.***************************************
  *Ensure that tank 1 (or 4) contains not *
  *more than 1,500 kg of fuel. Ensure that*
  *associated transfer tank contains not  *
  *less than 3,000 kg of fuel.            *
  *Set NORM - AFT TRIM control switch to  *
  *"AFT TRIM".  Carry out a fuel transfer *
  *test (Ref. 28-22-13, Adjustment/Test)  *
  *and check that fuel transfer ceases at *
  *correct tank fuel control level.       *
  *Set control switch to "NORM"; check    *
  *that fuel transfer into tank 1 (or 4)  *
  *is resumed.  IF -                      *
  *****************************************
                  |
                  |                  ----------------------------------
                  |                 |1. Fuel transfer does not cease   |
                NOT OK--------------|   at correct tank fuel control   |
                                    |   level with control switch at   |
                                    |   AFT TRIM - Chart 111.          |
                                     ----------------------------------
```

PUMP RUNS, BUT 'LOW PRESS' CAPTION IS NOT ILLUMINATED WHEN PUMP SWITCHED 'ON'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Repeat test (Ref. para.3.). Leave pump control switch at ON.

Trip pump supply CB (1), (3),(8),(9), (11),(12), (14),(15), (18),(19),(21) or (22). Check for 28 V d.c. output at CB (2),(6),(7), (10),(13) or (20).

- NO: Renew CB (2), (6),(7),(10), (13) or (20).
- YES: Apply local earth to Low Pressure Caption Light Module (80) to (89) as required, at terminal 2. Is caption illuminated?
  - NO: *Renew Low Pressure Caption Light Module (80) to (89), as required.
  - YES: Check for continuity between terminals 1 and 2 at Pump Control Switch (70),(71) or (73), or terminals 4 and 5 at Pump Control Switch (68). (69),(72),(74) or (75), or terminals 5 and 6 at Pump Control Switch (76),(77),(78) or (79).
    - NO: Renew Pump Control Switch (68) to (79), as required.
    - YES: Continued on Sheet 2

Chart 101 (Sheet 1 of 2)

```
                              Continued from Sheet 1
                                          |
                                          |
 --------------              ------------------------------
|Check Pressure|            |Disconnect electrical         |
|Switch sense  |-YES-       |connector at Pressure Switch  |
|line for      |            |(56) to (67), as required.    |
|blockage.     |            |Check for continuity at fixed|
 --------------             |connector pins A and B.       |
        |                    ------------------------------
        NO                          |
        |                           NO
 --------------                     |
|Check for     |               ------------
|blockage of   |              |Renew       |
|filter screen |              |Pressure    |
|at Fuel Pump  |              |Switch (56) |
|(28) to (39), |              |to (67), as |
|as required.  |              |required.   |
 --------------                ------------
```

Chart 101 (Sheet 2 of 2)

PUMP DOES NOT RUN AND 'LOW PRESS' CAPTION REMAINS ILLUMINATED WHEN PUMP IS SWITCHED 'ON'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Disconnect electrical connector at Fuel Pump (28),(30),(31),(32) (33),(34),(35),(37),(38) or (39). Check free connector for 200/115 V a.c. 3-ph supply.

- -YES- → Renew Fuel Pump (28), (30),(31), (32),(33), (34),(35), (37),(38), or (39).
- --- Repeat test (Ref. para.3.). Leave pump control switch at ON.
- NO ↓

At fuel contactor box, remove Pump Control Relay (44),(46),(47),(48), (49),(50),(52),(53),(54) or (55) and check for 200/115 V a.c. supply at relay socket pins A2,B2, and C2.

- -NO- → Check CB (1),(8), (9),(11), (12),(14), (18),(19), (21) or (22) for 200/115 V a.c. 3-ph output.
  - NO ↓ Renew CB (1),(8), (9),(11), (12),(14), (18),(19), (21) or (22).
- YES ↓

Check for 115 V a.c. across relay socket pins X1 and X2.

- -YES- → Renew Pump Control Relay (44) (46),(47), (48),(49), (50),(52), (53),(54) or (55).
- NO ↓

Check Pump Control Switch (68), (69),(72),(76),(77),(78) or (79) for continuity through terminals 1 and 2 or Pump Control Switch (70),(71) or (73) for continuity through terminals 4 and 5.

- -NO- → Renew Pump Control Switch (68) to (73) or (76) to (79), as required.

Chart 102

PUMP DOES NOT RUN AND 'LOW PRESS' CAPTION REMAINS ILLUMINATED WHEN PUMP IS SWITCHED 'ON'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Repeat test (Ref.para. 3.). Leave pump control switch at ON. ---- Disconnect electrical connector at Fuel Pump (29) or (36). Check free connector for 200/115 V a.c. 3-ph supply.

- YES: Renew Fuel Pump (29) or (36).
- NO: At fuel contactor box, remove Pump Control Relay (45) or (51) and check for 200/115 V a.c. at relay socket pins A2, B2 and C2.

At fuel contactor box, remove Pump Control Relay (45) or (51) and check for 200/115 V a.c. at relay socket pins A2, B2 and C2.

- NO: Check CB (3) or (15) for 200/115 V a.c. 3-ph output.
  - NO: Renew CB (3) or (15)
- YES: Check for 115 V a.c. across relay socket pins X1 and X2.
  - YES: Renew Pump Control Relay (45) or (51).
  - NO: Check CB (4) or (16) for 115 V a.c. output
    - YES: *Renew Pump Control Switch (74) or (75).
    - NO: Renew CB (4) or (16).

Chart 103

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```
********************************
*PUMP DOES NOT RUN AND 'LOW    *
*PRESS' CAPTION REMAINS        *
*ILLUMINATED WHEN PUMP IS      *
*SWITCHED TO 'EMER'.           *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------       --------------       --------------
|Repeat test   |     |Check CB (5)  |     |*Renew Pump   |
|(Ref.para.3.).|-----|or (17) for   |-YES-|Control Switch|
|Leave pump    |     |115 V a.c.    |     |(74) or (75). |
|control switch|     |output.       |      --------------
|at EMER.      |      --------------
 --------------             |
                            NO
                            |
                      --------------
                     |Renew CB (5)  |
                     |or (17).      |
                      --------------
```

Chart 104

VALVE DOES NOT 'OPEN/SHUT' WHEN CONTROL SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Repeat test (Ref.para. 4.). Leave valve control switch at SHUT.

Disconnect electrical connector at Transfer Shut-off Valve (40) or (41). Check free connector for 28 V d.c. at pin C. With control switch at OPEN, check free connector for 28 V d.c. at pin B.

-YES- *Renew Transfer Shut-off Valve (40) or (41).

NO

Check CB (23) or (24) for 28 V d.c. output.

-NO- Renew CB (23) or (24).

-YES- With control switch at SHUT, remove Control Relay (94) or (95) and check for 28 V a.c. across relay socket pins X1 and X2.

-YES- Renew Control Relay (94) or (95).

NO

*Renew Control Switch (92) or (93).

Chart 105

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MAGNETIC INDICATOR FAULTY, WITH CORRECT VALVE OPERATION.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

- Disconnect electrical connector at Transfer Shut-off Valve (40) or (41).
- With transfer shut-off valve shut, check for continuity through valve fixed connector pins C-D. With valve open, check for continuity through pins B-E.
  - YES: *Renew valve magnetic Indicator (96) or (97).
  - NO: Renew Transfer Shut-off Valve (40) or (41).

Chart 106

TRANSFER SHUT-OFF VALVE DOES NOT SHUT AUTOMATICALLY WHEN PUMP SWITCHED 'ON'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Repeat test (Ref. para.4.). Leave pump control switch at ON and transfer valve control switch at OPEN.

Check Pump Control Switch (76),(77),(78) or (79), for continuity between pins 3 and 4.

--NO-- Renew Pump Control Switch (76),(77),(78) or (79).

YES

*Renew Level Switching Pack (90) or (91). If not OK, refer to 28-42-00, Trouble Shooting.

Chart 107

VALVE DOES NOT 'OPEN/SHUT' WHEN CONTROL SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------------      ----------------          -----------------
|Repeat test (Ref.|    |Disconnect      |        |*Renew Inter-    |
|para.5.). Leave  |----|electrical      |-YES-   |connect Valve    |
|valve control    |    |connector at    |        |(42) or (43).    |
|switch at SHUT.  |    |Interconnect    |         -----------------
 -----------------     |Valve (42) or   |
                       |(43). Check free|
                       |connector for   |
                       |28 V d.c. at pin|
                       |C.  With control|
                       |switch at OPEN, |
                       |check free      |
                       |connector for   |
                       |28 V d.c. at pin|
                       |B.              |
                        ----------------
                               |
                               NO
                               |
 -----------------      ----------------          -----------------
|Renew CB (25) or |    |Check CB (25) or|        |*Renew Control   |
|(26).            |-NO-|(26) for 28 V   |-YES-   |Switch (98) or   |
 -----------------     |d.c. output.    |        |(99).            |
                        ----------------          -----------------
```

Chart 108

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```
********************************         ------------------------------
*MAGNETIC INDICATOR FAULTY,    *        |GROUND EQUIPMENT REQUIRED     |
*WITH CORRECT VALVE OPERATION.*         |------------------------------|
********************************        |DESCRIPTION         PART NO.  |
                                        |------------------------------|
                                        |GROUND POWER SUPPLY   -       |
                                        |MULTIMETER            -       |
                                         ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------        ----------------          ----------------
|Disconnect      |      |With interconnect|       |*Renew valve    |
|electrical      |------|valve shut,      |-YES-  |magnetic        |
|connector at    |      |check for        |       |Indicator (100) |
|Interconnect    |      |continuity       |       |or (101).       |
|Valve (42) or   |      |through valve    |        ----------------
|(43).           |      |fixed connector  |
 ----------------       |pins C-E. With   |
                        |valve open, check|
                        |for continuity   |
                        |through pins B-D.|
                         ----------------
                                |
                                NO
                                |
                         -----------------
                        |Renew Interconnect|
                        |Valve (42) or     |
                        |(43).             |
                         -----------------
```

Chart 109

MAGNETIC INDICATOR FAULTY WHEN SWITCH OPERATED 'NORM - AFT TRIM - NORM'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------      ----------------         ---------------
|Repeat test (Ref.|-----|Check CB (27) for |--NO-|Renew CB (27).  |
|para.6.). Leave  |     |28 V d.c. output. |      ---------------
|control switch at|      ----------------
|NORM.            |             |
 ----------------              YES
                                |
                        ----------------         ---------------
                       |Check NORM - AFT  |--NO-|*Renew NORM -   |
                       |TRIM Indicator    |     |AFT TRIM Control|
                       |(107) for 28 V    |     |Switch (106).   |
                       |d.c. at pin A.    |      ---------------
                        ----------------
                                |
                               YES
                                |
                        ----------------         ---------------
                       |Set control switch|--NO-|*Renew NORM -   |
                       |to "AFT TRIM";    |     |AFT TRIM Control|
                       |check NORM - AFT  |     |Switch (106).   |
                       |TRIM Indicator    |      ---------------
                       |(107) for 28 V at |
                       |pin C.            |
                        ----------------
                                |
                               YES
                                |
                        ----------------
                       |Renew NORM - AFT  |
                       |TRIM Indicator    |
                       |(107).            |
                        ----------------
```

Chart 110

FUEL TRANSFER DOES NOT CEASE AT CORRECT TANK FUEL CONTROL LEVEL WITH CONTROL SWITCH AT 'AFT TRIM'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Open access panel at Solenoid Valve (102),(103),(104) or (105). Operate control switch to "AFT TRIM" and then to "NORM", checking that the solenoid valve is heard to operate.

- NO → Set control switch to "AFT TRIM". Disconnect electrical connector at Solenoid Valve (102) (103), (104) or (105). Check free connector for 28 V d.c. at pin A.
  - NO → Check for O/C between control switch and solenoid valve.
  - YES → *Renew Solenoid Valve (102) (103),(104) or (105).
- YES → Check Transfer Control Valve Sensor (119),(120),(127) or (128) (Ref. 28-22-11, Adjustment/Test). Is fault cleared?
  - NO → Check Transfer Control Valve (109) to (116) (Ref. 28-22-12 Adjustment/Test).

Chart 111

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1) Circuit breaker 200/115 V	-	14-215	Q911	Map ref.G17	24-50-00 R/I	28-22-06
(2) Circuit breaker 28 V	-	15-215	Q895	Map ref.C25	24-50-00 R/I	28-22-06
(3) Circuit breaker 200/115 V	-	4-213	Q905	Map ref.D5	24-50-00 R/I	28-22-06
(4) Circuit breaker 115 V	-	14-216	Q897	Map ref.C4	24-50-00 R/I	28-22-06
(5) Circuit breaker 115 V	-	4-213	Q898	Map ref.D3	24-50-00 R/I	28-22-06
(6) Circuit breaker 28 V	-	15-216	Q893	Map ref.A5	24-50-00 R/I	28-22-06
(7) Circuit breaker 28 V	-	15-215	Q894	Map ref.C24	24-50-00 R/I	28-22-06
(8) Circuit breaker 200/115 V	-	13-215	Q906	Map ref.E19	24-50-00 R/I	28-22-06
(9) Circuit breaker 200/115 V	-	13-215	Q902	Map ref.A19	24-50-00 R/I	28-22-06
(10) Circuit breaker 28 V	-	15-215	Q891	Map ref.C23	24-50-00 R/I	28-22-06
(11) Circuit breaker 200/115 V	-	14-215	Q901	Map ref.E14	24-50-00 R/I	28-22-06
(12) Circuit breaker	-	13-216	Q912	Map ref.F1	24-50-00 R/I	28-22-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
200/115 V						
(13) Circuit breaker 28 V	-	15-216	Q896	Map ref.A6	24-50-00 R/I	28-22-06
(14) Circuit breaker 200/115 V	-	14-216	Q909	Map ref.D1	24-50-00 R/I	28-22-07
(15) Circuit breaker 200/115 V	-	4-213	Q908	Map ref.C8	24-50-00 R/I	28-22-07
(16) Circuit breaker 115 V	-	13-216	Q899	Map ref.E5	24-50-00 R/I	28-22-07
(17) Circuit breaker 115 V	-	4-213	Q900	Map ref.C3	24-50-00 R/I	28-22-07
(18) Circuit breaker 200/115 V	-	14-215	Q907	Map ref.E17	24-50-00 R/I	28-22-07
(19) Circuit breaker 200/115 V	-	13-216	Q903	Map ref.C4	24-50-00 R/I	28-22-07
(20) Circuit breaker 28 V	-	15-216	Q892	Map ref.A7	24-50-00 R/I	28-22-07
(21) Circuit breaker 200/115 V	-	14-216	Q904	Map ref.D4	24-50-00 R/I	28-22-07
(22) Circuit breaker 200/115 V	-	13-215	Q910	Map ref.G19	24-50-00 R/I	28-22-07
(23) Circuit breaker 28 V	-	15-215	Q6668	Map ref.G24	24-50-00 R/I	28-22-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(24) Circuit breaker 28 V	-	15-216	Q6669	Map ref.F7	24-50-00 R/I	28-22-08
(25) Circuit breaker 28 V	-	1-213	Q872	Map ref.L12	24-50-00 R/I	28-22-11
(26) Circuit breaker 28 V	-	3-213	Q871	Map ref.B7	24-50-00 R/I	28-22-11
(27) Circuit breaker 28 V	-	15-216	Q2101	Map ref.C7	24-50-00 R/I	28-22-51
(28) Fuel pump (fwd.), tank 6-1	147 BB	-	Q971	In tank 6	28-22-21 R/I	28-22-06
(29) Fuel pump (fwd.), tank 5-1	193 NB	-	Q965	In tank 5	28-22-21 R/I	28-22-06
(30) Fuel pump (aft), tank 5-2	193 NB	-	Q966	In tank 5	28-22-21 R/I	28-22-06
(31) Fuel pump (aft), tank 6-2	147 CB	-	Q972	In tank 6	28-22-21 R/I	28-22-06
(32) Fuel pump, tank 5A (inner)	553 EB	-	Q962	In tank 5A sump	28-22-22 R/I	28-22-06
(33) Fuel pump, tank 5A (outer)	553 EB	-	Q961	In tank 5A sump	28-22-22 R/I	28-22-06
(34) Fuel pump (fwd.), tank 8-4	143 BB	-	Q969	In tank 8	28-22-21 R/I	28-22-07
(35) Fuel	196 DB	-	Q967	In tank 7	28-22-21	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
pump (fwd.), tank 7-4					R/I	
(36) Fuel pump (aft), tank 7-3	196 EB	-	Q968	In tank 7	28-22-21 R/I	28-22-07
(37) Fuel pump (aft), tank 8-3	143 CB	-	Q970	In tank 8	28-22-21 R/I	28-22-07
(38) Fuel pump, tank 7A (inner)	653 EB	-	Q963	In tank 7A sump	28-22-22 R/I	28-22-07
(39) Fuel pump, tank 7A (outer)	653 EB	-	Q964	In tank 7A sump	28-22-22 R/I	28-22-07
(40) Transfer shut-off valve, tank 5	532 AT	-	Q6682	Tank 6 rear wall	28-22-26 R/I	28-22-08
(41) Transfer shut-off valve, tank 7	632 AT	-	Q6681	Tank 7 rear wall	28-22-26 R/I	28-22-08
(42) Inter-connect valve, tanks 6-7	196 EB	-	Q878	Between tanks 6 and 7	28-22-24 R/I	28-22-11
(43) Inter-connect valve, tanks 5-8	193 GB	-	Q877	Between tanks 5 and 8	28-22-24 R/I	28-22-11
(44) Pump control relay, tank 6-1 (fwd.)	-	24-123	Q945	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-06
(45) Pump control	-	22-123	Q939	LH fuel contactor	28-00-00 R/I	28-22-06

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
relay, tank 5-1 (fwd.)				box, fwd. underfloor racking		
(46) Pump control relay, tank 5-2 (aft)	-	22-123	Q940	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-06
(47) Pump control relay, tank 6-2 (aft)	-	22-123	Q946	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-06
(48) Pump control relay, tank 5A (inner)	-	22-123	Q936	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-06
(49) Pump control relay, tank 5A (outer)	-	22-123	Q935	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-06
(50) Pump control relay, tank 8-3 (aft)	-	24-123	Q944	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07
(51) Pump control relay, tank 7-3 (aft)	-	24-123	Q942	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07
(52) Pump control relay, tank 7-4 (fwd.)	-	24-123	Q941	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(53) Pump control relay, tank 8-4 (fwd.)	-	22-123	Q943	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07
(54) Pump control relay, tank 7A (inner)	-	24-123	Q938	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07
(55) Pump control relay, tank 7A (outer)	-	24-123	Q937	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-22-07
(56) Pressure switch, tank 6-1 (fwd.)	195 JB	-	Q959	Below tank	28-22-23 R/I	28-22-06
(57) Pressure switch, tank 5-1 (fwd.)	193 FB	-	Q953	Below tank	28-22-23 R/I	28-22-06
(58) Pressure switch, tank 5-2 (aft)	193 MB	-	Q954	Below tank	28-22-23 R/I	28-22-06
(59) Pressure switch, tank 5A (inner)	553 EB	-	Q950	Outside tank sump	28-22-23 R/I	28-22-06
(60) Pressure switch, tank 5A (outer)	553 EB	-	Q949	Outside tank sump	28-22-23 R/I	28-22-06
(61) Pressure switch, tank 6-2 (aft)	195 KB	-	Q960	Below tank	28-22-23 R/I	28-22-06
(62) Pressure switch, tank 8-4 (fwd.)	194 MB	-	Q957	Below tank	28-22-23 R/I	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(63) Pressure switch, tank 7-3 (aft)	196 DB	-	Q956	Below tank	28-22-23 R/I	28-22-07
(64) Pressure switch, tank 7-4 (fwd.)	196 BB	-	Q955	Below tank	28-22-23 R/I	28-22-07
(65) Pressure switch, tank 7A (inner)	653 EB	-	Q952	Outside tank sump	28-22-23 R/I	28-22-07
(66) Pressure switch, tank 7A (outer)	653 EB	-	Q951	Outside tank sump	28-22-23 R/I	28-22-07
(67) Pressure switch, tank 8-3 (aft)	194 MB	-	Q958	Below tank	28-22-23 R/I	28-22-07
(68) RH pump control switch, tank 5	-	5-214	Q928	3CM station	28-00-00 R/I	28-22-06
(69) LH pump control switch, tank 6	-	5-214	Q933	3CM station	28-00-00 R/I	28-22-06
(70) RH pump control switch, tank 6	-	5-214	Q934	3CM station	28-00-00 R/I	28-22-06
(71) RH pump control switch, tank 7	-	5-214	Q929	3CM station	28-00-00 R/I	28-22-07
(72) RH pump control switch, tank 8	-	5-214	Q931	3CM station	28-00-00 R/I	28-22-07
(73) LH pump control switch, tank 8	-	5-214	Q932	3CM station	28-00-00 R/I	28-22-07
(74) LH pump	-	5-214	Q927	3CM station	28-00-00	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
control switch, tank 5					R/I	
(75) LH pump control switch, tank 7	-	5-214	Q930	3CM station	28-00-00 R/I	28-22-07
(76) RH pump control switch, tank 5A	-	2-214	Q924	3CM station	28-00-00 R/I	28-22-06
(77) LH pump control switch, tank 5A	-	2-214	Q923	3CM station	28-00-00 R/I	28-22-06
(78) LH pump control switch, tank 7A	-	2-214	Q925	3CM station	28-00-00 R/I	28-22-07
(79) RH pump control switch, tank 7A	-	2-214	Q926	3CM station	28-00-00 R/I	28-22-07
(80) Low pressure caption light module, tank 5 LH	-	5-214	Q915	3CM station	28-00-00 R/I	28-22-06
(81) Low pressure caption light module, tank 5 RH	-	5-214	Q916	3CM station	28-00-00 R/I	28-22-06
(82) Low pressure caption light module, tank 6 LH	-	5-214	Q921	3CM station	28-00-00 R/I	28-22-06
(83) Low pressure caption light module,	-	5-214	Q922	3CM station	28-00-00 R/I	28-22-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
tank 6 RH						
(84) Low pressure caption light module, tank 7 LH	-	5-214	Q918	3CM station	28-00-00 R/I	28-22-07
(85) Low pressure caption light module, tank 7 RH	-	5-214	Q917	3CM station	28-00-00 R/I	28-22-07
(86) Low pressure caption light module, tank 8 LH	-	5-214	Q920	3CM station	28-00-00 R/I	28-22-07
(87) Low pressure caption light module, tank 8 RH	-	5-214	Q919	3CM station	28-00-00 R/I	28-22-07
(88) Low pressure caption light module, tank 5A	-	2-214	Q913	3CM station	28-00-00 R/I	28-22-06
(89) Low pressure caption light module, tank 7A	-	2-214	Q914	3CM station	28-00-00 R/I	28-22-07
(90) Level switching pack (LH)	-	10-216	Q1350	3CM station RH racking	28-42-51 R/I	28-42-05
(91) Level switching pack (RH)	-	2-216	Q1351	3CM station RH racking	28-42-51 R/I	28-42-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(92) Control switch, transfer valve (5A-5)	-	5-214	Q6671	3CM station	28-00-00 R/I	28-22-08
(93) Control switch, transfer valve (7A-7)	-	5-214	Q6672	3CM station	28-00-00 R/I	28-22-08
(94) Control relay, transfer valve (5A-5)	-	15-123	Q6677	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-22-08
(95) Control relay, transfer valve (7A-7)	-	18-123	Q6678	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-22-08
(96) Indicator transfer valve (5A-5)	-	5-214	Q6675	3CM station	28-00-00 R/I	28-22-08
(97) Indicator transfer valve (7A-7)	-	5-214	Q6676	3CM station	28-00-00 R/I	28-22-08
(98) Control switch, interconnect valve (6-7)	-	5-214	Q876	3CM station	28-00-00 R/I	28-22-11
(99) Control switch, interconnect valve (5-8)	-	5-214	Q875	3CM station	28-00-00 R/I	28-22-11
(100) Indicator, interconnect valve (6-7)	-	5-214	Q874	3CM station	28-00-00 R/I	28-22-11

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(101) Indicator, interconnect valve (5-8)	-	5-214	Q873	3CM station	28-00-00 R/I	28-22-11
(102) Solenoid valve (RH)	292 JT	-	Q2106	Wing root fillet	28-22-13 R/I	28-22-51
(103) Solenoid valve (RH)	292 JT	-	Q2105	Wing root fillet	28-22-13 R/I	28-22-51
(104) Solenoid valve (LH)	291 JT	-	Q2107	Wing root fillet	28-22-13 R/I	28-22-51
(105) Solenoid valve (LH)	291 JT	-	Q2108	Wing root fillet	28-22-13 R/I	28-22-51
(106) Control switch, NORM - AFT TRIM	-	5-214	Q2102	3CM station	28-00-00 R/I	28-22-51
(107) Indicator, NORM - AFT TRIM	-	5-214	Q2103	3CM station	28-00-00 R/I	28-22-51
(108) Control relay, underfull inhibit	-	18-123	Q2104	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-22-51
(109) Transfer control valve	526 GT	-	-	In tank 2 (inboard)	28-22-12 R/I	-
(110) Transfer control valve	524 NT	-	-	In tank 5 (outboard)	28-22-12 R/I	-
(111) Transfer control valve	524 PT	-	-	In tank 5 (inboard, fwd.)	28-22-12 R/I	-
(112) Transfer control valve	524 RT	-	-	In tank 5 (inboard, aft)	28-22-12 R/I	-

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(113) Transfer control valve	625 FU	-	-	In tank 7 (inboard)	28-22-12 R/I	-
(114) Transfer control valve	624 NT	-	-	In tank 8 (outboard)	28-22-12 R/I	-
(115) Transfer control valve	624 PT	-	-	In tank 8 (inboard, fwd.)	28-22-12 R/I	-
(116) Transfer control valve	624 QT	-	-	In tank 8 (inboard, aft)	28-22-12 R/I	-
(117) Sensor, transfer control valve	523 CT	-	-	In tank 1 top (upper)	28-22-11 R/I	-
(118) Sensor, transfer control valve	523 CT	-	-	In tank 1 top (lower)	28-22-11 R/I	-
(119) Sensor, transfer control valve	523 CT	-	-	In tank 1 reduced level (upper)	28-22-11 R/I	-
(120) Sensor, transfer control valve	523 CT	-	-	In tank 1 reduced level (lower)	28-22-11 R/I	-
(121) Sensor, transfer control valve	526 BT	-	-	In tank 2 top (upper)	28-22-11 R/I	-
(122) Sensor, transfer control valve	526 BT	-	-	In tank 2 top (lower)	28-22-11 R/I	-
(123) Sensor, transfer control valve	626 BT	-	-	In tank 3 top (upper)	28-22-11 R/I	-
(124) Sensor,	626 BT	-	-	In tank 3	28-22-11	-

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
transfer control valve				top (lower)	R/I	
(125) Sensor, transfer control valve	623 CT	-	-	In tank 4 top (upper)	28-22-11 R/I	-
(126) Sensor, transfer control valve	623 CT	-	-	In tank 4 top (lower)	28-22-11 R/I	-
(127) Sensor, transfer control valve	623 CT	-	-	In tank 4 reduced level (upper)	28-22-11 R/I	-
(128) Sensor, transfer control valve	623 CT	-	-	In tank 4 reduced level (lower)	28-22-11 R/I	-

Component Identification
Table 101

MAIN TRANSFER SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE AIRCRAFT GROUND STABILITY SAFETY PRECAUTIONS DETAILED IN 12-00-10.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig.501)

The control switches and indication equipment for the transfer pumps and interconnect valves are disposed in a fuel-flow pattern on the fuel system management panel at the 3CM station.

The TRANS VALVE switches, for manual control of fuel transfer from tanks 5A to 5 and 7A to 7, and their magnetic indicators, are grouped with the pump control switches and indicators, centre-left and centre-right of the panel.

Between these groups are the INTER-CON switches for tanks 6 to 7 and 5 to 8 and the associated magnetic indicators.

In the panel centre is the NORM - AFT TRIM switch, which controls fuel in tanks 1 and 4 at a lower content level, and the magnetic indicator.

Operational Tests and Functional (leakage) Tests of the system upstream and downstream of the transfer control valves (or 1 in transfer shut-off valves, as appropriate) and of the sensor systems are detailed in the following procedures.

A System Test is not applicable.

2. Operational Test - Main System

A. Prepare to Test Main System

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing), that the INTER-CON VALVE (6-7 and 5-8) switches are set to "SHUT" and that the TANKS 1 and 4 NORM - AFT TRIM switch is at "NORM".

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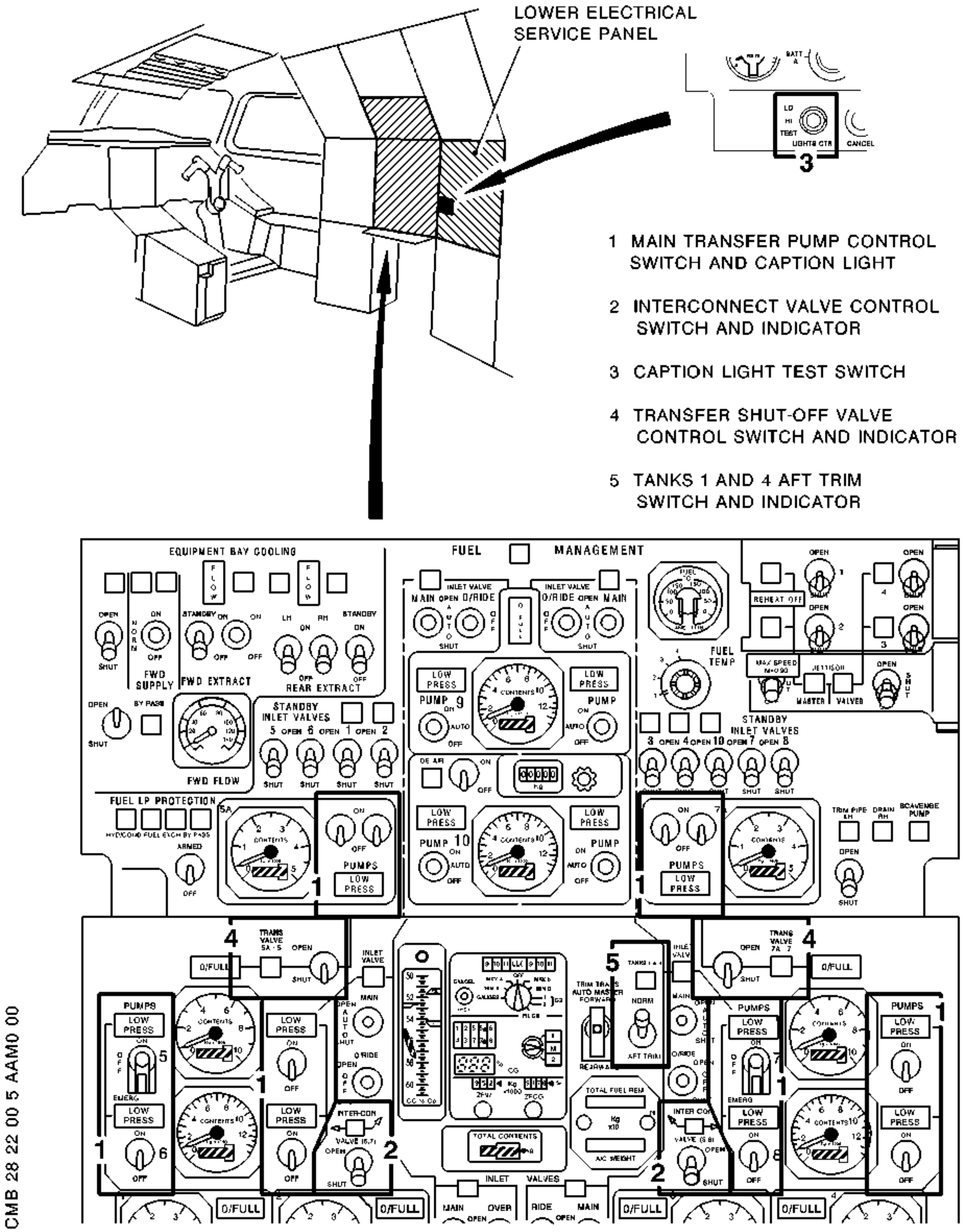

Main Transfer Controls and Indication
Figure 501

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NOTE: There are twelve pump switches, one for each main transfer pump, for each of tanks 5, 6, 7, 8, 5A and 7A, an interconnect valve switch each, for tanks 6 to 7 and 5 to 8, a transfer valve switch each for tanks 5A and 7A and a switch for tanks 1 and 4 aft trim selection.

B. Test Main System

(1) Set the switch labelled LIGHTS CTR at the bottom left corner of electrics panel 6-214 to "TEST" and check that all captions on the fuel management panel are illuminated. Release the switch and check that the captions are extinguished.

(2) Check the fuel contents indicators and ensure that the tanks contain fuel. Set one pump switch to "ON". Check that the associated LOW PRESS caption is illuminated, and is then extinguished within 3 s, indicating that the pump is operating. Set the switch to "OFF". Repeat the check in succession with all other transfer pump switches.

(3) Set the tank 5A-5 TRANS VALVE switch to "OPEN". Check that the magnetic indicator display changes from bar-across-line to diagonal stripes than to bar-in-line. Set the switch to "SHUT" and check that the indicator display changes from bar-in-line to diagonal stripes then to bar-across-line. Ensure that the switch locks correctly in both positions, then leave it locked in the valve SHUT position.

(4) Repeat operation (3) as applied to the tank 7A-7 TRANS VALVE switch.

(5) Set one INTER-CON VALVE switch to "OPEN" and then to "SHUT". Check that the magnetic indicator display changes from SHUT to diagonal stripes then to OPEN, and then changes from OPEN to diagonal stripes then to SHUT. Repeat the check on the other INTER-CON VALVE switch.

(6) Set the TANKS 1 and 4 NORM - AFT TRIM switch to "AFT TRIM" and then to "NORM". In each instance check that the associated magnetic indicator shows AFT and NORM for the corresponding valve position. Ensure that the switch locks correctly in both positions, then leave it locked in the valve NORM position.

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C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

3. Operational Test - Tanks 5 and 7 Pumps (Emergency Selection)

A. Prepare to Test Tanks 5 and 7 Pumps (Emergency Selection)

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Ensure that the tanks contain sufficient fuel for the test.

B. Test Tanks 5 and 7 Pumps (Emergency Selection)

NOTE: The left-side switches for the tank 5 and 7 pumps are fitted with a guard that must be operated before the switch can be set to EMERG.

(1) Set the tank 5 pump switch to "EMERG". Check that the associated LOW PRESS caption is illuminated and extinguished within 3 s. Set switch to centre "OFF".

(2) Repeat operation (1) as applied to the tank 7 pumps switch.

NOTE: The 1st standby pump switch in the engine feed system (Ref. 28-21-00) for tanks 2 and 4 is the centre switch in the group of three.

(3) Set the tank 2 1st standby pump switch to "ON". Check that the associated LOW PRESS caption is illuminated and extinguished within 2 s.

(4) Set the tank 5 pump switch to "EMERG". Check that the tank 2 1st standby pump stops running and its associated LOW PRESS caption is illuminated.

(5) Reset the tank 5 pump switch to centre "OFF". Check that the tank 2 1st standby pump operates and its associated LOW PRESS caption is extinguished. Set the tank 2 pump switch to "OFF".

(6) Set the tank 4 1st standby pump switch to "ON". Check that the associated LOW PRESS caption is illuminated and extinguished within 2 s.

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(7) Set the tank 7 pump switch to "EMERG". Check that the tank 4 1st standby pump stops running and its associated LOW PRESS caption is illuminated.

(8) Reset the tank 7 pump switch to centre "OFF". Check that the tank 4 1st standby pump operates and its associated LOW PRESS caption is extinguished. Set the tank 4 pump switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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4. Operational Test - Interconnect Valves

A. Prepare to Test Interconnect Valves

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Ensure that the associated INTER-CON VALVE (Tanks 6-7 and 5-8) magnetic indicator displays SHUT.

B. Test Interconnect Valves

(1) Set each INTER-CON VALVE switch to "OPEN".

(2) Check that the associated magnetic indicator display changes to diagonal stripes and then to OPEN within 2 s of switch operation.

(3) Set each INTER-CON VALVE switch to "SHUT".

(4) Check that the associated magnetic indicator display changes to diagonal stripes and then to SHUT within 2 s of switch operation.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

5. Operational Test - Underfull Inhibit (Tanks 1 and 4)

A. Prepare to Test Underfull Inhibit (Tanks 1 and 4)

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Ensure that the quantity of fuel in each of tanks 1 and 4 is not greater than 3,000 kg. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing) as required.

(4) Ensure that tanks 6 and 7 each contain sufficient fuel to allow a forward fuel transfer of not less than 1,500 kg.

B. Test Underfull Inhibit (Tanks 1 and 4)

(1) With the NORM - AFT TRIM switch at NORM, check that tanks 1 and 4 U/FULL captions are illuminated and the associated magnetic indicator displays NORM.

NOTE: The diagonal stripes are displayed on the magnetic indicator only when electrical ground power is off.

(2) Set the NORM - AFT TRIM switch to "AFT TRIM". Check that tanks 1 and 4 U/FULL captions are extinguished and the associated magnetic indicator displays AFT.

(3) Set the NORM - AFT TRIM switch to "NORM". Check that tanks 1 and 4 U/FULL captions are illuminated.

(4) Set tank 6 LH and tank 7 RH pump switches to "ON".

(5) Allow fuel to transfer into tanks 1 and 4. Check that as the fuel levels rise above approximately 80 percent of tank volume (3,390 kg), the U/FULL captions are extinguished.

(6) Set the pump switches to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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6. Functional Test - Transfer Shut-off Levels (Tanks 1 and 4)

A. Equipment and Materials

DESCRIPTION	PART NO.
Receptacle, 50 gal (Imp.) (227 l) capacity, for fuel spillage.	-
Bonding lead, for above receptacle	-

B. Prepare to Test Transfer Shut-off Levels (Tanks 1 and 4)

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WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT THE TRANSFER OF FUEL WITHOUT AIRCRAFT OVERBALANCE OCCURRING (REF. 28-00-00, SERVICING, 'FUEL TRANSFER ON THE GROUND').

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00), that the aircraft is laterally level (0 deg roll) and longitudinally between level and 1 3/4 deg nose-up (between 0 and +1 3/4 deg pitch). Reposition the aircraft if necessary.

(2) Position a 50 gal (Imp.) (227 l) receptacle beneath the overflow/relief valve outlet in case of inadvertent fuel spillage. Electrically bond the receptacle to the aircraft.

(3) Make available electrical ground power as detailed in 24-41-00, Servicing.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(5) Set the fuel tank loads as follows, and refuel (Ref. 12-11-28), transfer fuel (Ref. 28-00-00, Servicing), or defuel (Ref. 28-25-00) as required.

(a) Tank 9 - full.

(b) Tank 10 - full.

(c) Tank 1 - 1,000 kg.

(d) Tank 4 - 1,000 kg.

(e) Tank 6 - 5,000 kg.

(f) Tank 8 - 10,000 kg.

(g) Tank 5 - full.

(h) Tank 7 - 2,000 kg.

(j) Tank 2 - 2,000 kg.

(k) Tank 3 - 2,000 kg.

(l) Remaining tanks - empty, i.e., at unusable level.

(6) Check that tanks 1 and 4 U/FULL captions are illuminated.

C. Test Transfer Shut-off levels (Tanks 1 and 4)

(1) Set the TANKS 1 and 4 NORM - AFT TRIM switch to "AFT TRIM". Check that tanks 1 and 4 U/FULL captions are extinguished.

(2) Set tank 6 LH and tank 8 RH pump switches to "ON". Check that the LOW PRESS captions are illuminated and then extinguished as pump pressure builds up.

(3) Check, by reference to the FQIs, that fuel is transferring to tanks 1 and 4. When fuel transfer stops, set the pump switches to "OFF" and check that the fuel quantities are within the control levels shown in Table 501.

(4) Set tank 5 LH and tank 7 RH pump switches to "ON". Check that the LOW PRESS captions are illuminated and then extinguished as pump pressure builds up.

(5) Check, by reference to the FQIs, that fuel is transferring to tanks 1 and 4. When fuel transfer stops, set the pump switches to "OFF" and check that the fuel quantities are within the control levels shown in Table 501.

(6) Set the NORM - AFT TRIM switch to "NORM". Check that the magnetic indicator displays NORM and tanks 1 and 4 U/FULL captions are illuminated.

(7) Set tank 6 LH and tank 8 RH pump switches to "ON".

(8) During fuel transfer, check that, as the fuel levels rise above approximately 80 percent of tank volume (3,390 kg), tanks 1 and 4 U/FULL captions are extinguished.

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(9) When fuel transfer stops, set the pump switches to "OFF" and check that the fuel quantities are within the control levels shown in Table 501.

(10) Set tank 5 LH and tank 7 RH pump switches to "ON".

(11) When fuel transfer stops, set the pump switches to "OFF" and check that the fuel quantities are within the control levels shown in Table 501.

NOTE: A correction must be applied to the control level fuel quantity if the aircraft is not level (0 deg pitch and 0 deg roll). Table 501 shows the required correction in kilogrammes for each 10 minutes of nose-up pitch (above 0 deg).

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COLLECTOR TANKS TRIM SWITCH SETTING	TRANSFER PUMP SWITCHED ON	TANK FUEL CONTROL LEVEL (FQI)	CORRECTION (FOR EACH 10 minutes OF PITCH ABOVE 0 deg)
AFT TRIM AFT TRIM	Tank 6 LH) Tank 8 RH)	* 1,700 to 2,000 kg	Add 10 kg
AFT TRIM AFT TRIM	Tank 5 LH) Tank 7 RH)	** 1,700 to 2,000 kg	Add 10 kg
NORM NORM	Tank 6 LH) Tank 8 RH)	* 3,750 to 4,000 kg	Add 5 kg
NORM NORM	Tank 5 LH) Tank 7 RH)	** 3,750 to 4,000 kg	Add 5 kg

NOTE: The ** levels must be at least 50 kg higher than the * levels.

Tanks 1 and 4 Control levels
Table 501

D. Conclusion

(1) Disconnect the bonding lead and remove the receptacle from the overflow/relief valve outlet.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R 7. Main Transfer Pipe Leakage Test - Tanks 5, 6, 7 and 8

R NOTE: The following test may be applied to any one of the main
R transfer pipeline systems.

R A. Equipment and Materials

DESCRIPTION	PART NO.
R R Plexiglass viewing panels (local manufacture)	-

R B. Prepare to Test

R (1) Ensure tank(s) to be checked is/are empty of fuel.

R (2) Ensure that all fuel management panel switches are at their
R normal ground settings (Ref. 28-00-00, Servicing). Place a
R placard at the panel, warning that the position of the
R switches must not be altered.

R (3) Remove upper access panels, as required, from tanks 5, 6, 7
R and 8.

R Tank 5 - 524 AB, 524 FT, 524 GT and 524 HT
R Tank 6 - 525 AB, 525 HT, 525 ST, 525 TT, 525 XT, and 147 AB
R Tank 7 - 625 AB, 625 HT, 625 ST, 625 TT and 625 XT
R Tank 8 - 624 AB, 624 FT, 624 GT and 624 HT.

R (4) Cover fuel tank access with plexiglass viewing covers.

R (5) Make available electrical ground power as detailed in
R 24-41-00, Servicing.

R (6) Fill the appropriate tank(s) to 500 kg to cover main
R transfer fuel pump inlets of the pumps required for the
R pipes under test.

R (7) Tie up the appropriate main transfer float valves to prevent
R fuel transfer into the collector tanks.

R C. Main Transfer Pipe Leakage Test

R (1) On the third crew members fuel management panel set the
R associated main transfer pump(s) switch(es) to "ON".

R (2) Check the main transfer pipework for leakage by viewing
R through the plexiglass viewing covers.

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R (3) On the third crew members fuel management panel set the associated main transfer pump(s) switch(es) to "OFF".

R (4) Repeat paras. B.(6) and (7), and C.(1) to (3) for each affected tank.

R D. Conclusion

R (1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

R (2) Remove plexiglass viewing covers.

R (3) Untie the main transfer float valves which were tied up in para. B.(7).

R (4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R <u>NOTE</u>: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(5) Examine for corrosion the mating surfaces of the wing and tank access panels that were removed for access. Fit the panels.

R (6) Remove the placard from the fuel management panel.

R (7) Refuel as necessary (Ref. 12-11-28) and perform the Operational Test (Ref. para. 2. and/or 3., as required).

R (8) Check that there is no leakage of fuel from the disturbed panels.

R (9) Carry out a Functional Test of the de-aeration system (Ref. 28-13-00, Adjustment/Test), if the pipe joints have been disturbed.

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8. Functional Test (Sensor Leakage)

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel pressure test rig (capable of producing a fuel pressure of 0 to 25 psig (0 to 1.72 bar)	-
Transfer control valve three-way test element	E925114000

B. Prepare to Test Sensors for Leakage

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard on the panel warning that the positions of the switches must not be altered.

(2) Drain the tanks (Ref. 28-25-00) which contain the associated transfer control valve and sensor valve (Ref. Table 502) in the pipeline to be tested.

(3) Remove the appropriate access panels to obtain access to the associated components in the pipeline (Ref. Table 504).

(4) Gain access to the tanks (Ref. 28-10-00, Servicing).

(5) Remove the element from the transfer control valve and fit the three-way test element.

(6) Connect the test rig to the sensor line connection on the test element.

(7) Gain access to the sensor valve float arm(s) by releasing the three fasteners securing the cover plate to the sensor valve mounting box and removing the cover plate, which will remain suspended from a cable attached to the plate inner face.

(8) Raise the float arm of the associated sensor valve in the collector tank, then maintain it in this position to keep the valve closed. For sensor systems 5-1, 6-1, 7-4, 8-4, raise both sensors in each system and check both sensor lines with the upper sensor control solenoid in the NORM (de-energized) condition.

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C. Test Sensors for Leakage

(1) Operate the test rig and gradually pressurize the pipeline sufficiently to vent it of air. Depress the float arm a few times to assist air venting, then hold it manually in the upward (valve closed) position.

(2) Continue pressurizing the system until it is completely filled with fuel and the pressure has reached 25 psig (1.72 bar).

(3) Maintain the pressure and check all pipes, joints and couplings for freedom from leaks. No leakage is acceptable. Leakage across the closed sensor into the collector tank must not exceed 10 cc/min.

(4) Release the rig pressure to zero and disconnect the rig.

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D. Conclusion

(1) Check that the sensor float arms are moving freely.

(2) Fit the cover plate on the sensor float arm mounting box.

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Examine for freedom from corrosion the mating surfaces of the wing and tank access panels that were removed for component access. Fit the panels.

R (5) Remove the placard from the fuel management panel.

R (6) Refuel as necessary (Ref. 12-11-28) and perform the Operational Test (Ref. para.2.).

R (7) Check that there is no leakage of fuel from the disturbed panels.

TANK TRANSFER COMBINATIONS FROM TANK NO.	TO TANK NO.	PUMP LOCATION	SUB-SYSTEM COMPONENTS TCV & S OR TSOV	LOCATION (TANK NO.)	DE-AERATION INCORPORATED
5	1	Tank 5, fwd. pump	TCV & S	5	No
5	2	Tank 5, aft pump	TCV & S	5	No
6	1	Tank 6, fwd. pump, fuselage cell	TCV & S	5	No
6	2	Tank 6, aft pump, fuselage cell	TCV & S	2	Yes
7	3	Tank 7, aft pump	TCV & S	7	No
7	4	Tank 7, fwd. pump	TCV & S	8	No
8	3	Tank 8, aft pump, fuselage cell	TCV & S	8	No
8	4	Tank 8, fwd. pump, fuselage cell	TCV & S	8	Yes
5A	5	Both beneath tank 5A	TSOV	6	Yes
7A	7	Both beneath tank 7A	TSOV	7	Yes

Tank Transfer - System Details
Table 502 (continued)

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TANK TRANSFER COMBINATIONS		PUMP LOCATION	SUB-SYSTEM COMPONENTS		DE-AERATION INCORPORATED
FROM TANK NO.	TO TANK NO.		TCV & S OR TSOV	LOCATION (TANK NO.)	

TCV & S = Transfer Control Valve and Sensor

TSOV = Transfer Shut-off Valve

NOTE: Float-operated sensors associated with the transfer control valves are located in collector tanks 1 to 4.

Tank Transfer - System Details
Table 502 (concluded)

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9. Functional Test (System Leakage) - System Downstream of Transfer Control Valve or Transfer Shut-off Valve

NOTE: The following test is not applicable to sub-systems Tank 7A to 7 or Tank 6 to 2.

A. Equipment and Materials

DESCRIPTION	PART NO.
R	
R	
R	
R	
Before Modification SD0425	
Bung, pipe outlet, tank 5A-5	E925118001
Bung, pipe outlets, tanks 6-1, 5-1, 8-4, 7-4, 7-3	E925118002
Bung, pipe outlet, tanks 5-2, 8-3	E925118003
After Modification SD0425	
Blank, pipe outlets, tanks 5A-5, 5-2, 5-1, 6-1, 7-3, 7-4, 8-3, 8-4	E925119000

B. Prepare to Test for Leakage Downstream of Valves

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard on the panel warning that the positions of the switches must not be altered.

(2) Drain the tanks (Ref. 28-25-00) connected by the pipeline to be tested.

(3) Remove the appropriate access panels to obtain access to the associated components in the pipeline (Ref. Table 504).

(4) Gain access to the tank (Ref. 28-10-00, Servicing).

(5) If testing transfer system 5A to 5:

R
R
R (a) Fit the pipe outlet blank, 5A to 5, in the downstream pipe outlet in tank 5.

R (b) Open the 5A to 5 transfer shut-off valve.
R
R
R (6) Blank off the downstream pipe outlets using the appropriate blanks.

R (7) Fill the system using the associated trim transfer pump and
R bleed through the blanking adapter.
R
R

C. Test for Leakage Downstream of Valves

(1) Pressurize the system using the associated trim transfer pump. Maintain the pressure and check all pipes, couplings and joints for leakage. No leakage is acceptable.

(2) Set to "OFF" the associated trim transfer pump.

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(3) On the tank 5A to 5 system:

(a) Close the transfer shut-off valve.

(b) Remove the blank from the downstream pipe outlet in tank 5.

R
R
R (4) Remove the blank from the pipe outlet, after making provision to collect the fuel in the pipe.

R (5) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (6) Examine for freedom from corrosion the mating surfaces of the wing and the tank access panels that were removed for component access. Clean the surfaces and lightly smear them, if necessary, with grease Aeroshell 16. Fit the panels.

D. Conclusion

(1) Remove the placard from the fuel management panel.

(2) Refuel as necessary (Ref. 12-11-28) and perform the Operational Test (Ref. para.2. or 3.).

(3) Check that there is no leakage of fuel from the disturbed panels.

10. System Flow Rate Test

A. Prepare to Test System Flow Rate

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that the receiver tank associated with the pump that is to be operated does not contain more than the maximum content, given in Table 503, to allow a 3 min flow test.

(3) Ensure that the NORM - AFT TRIM switch is set to "NORM".

B. Test System Flow Rate

(1) Observe the contents indicator of the tank to receive the fuel. Set the appropriate pump switch to "ON" for 3 min and then set it to "OFF". Calculate the quantity of fuel transferred, then refer to Table 503 and check that the minimum flow rate per minute is correct. (To transfer fuel from tanks 5A and 7A, set the appropriate TRANS VALVE to "OPEN", in addition to setting pumps "ON").

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FROM TRANS. TANK NO.	TO TANK NO.	SWITCH (ON FUEL MANAGEMENT PANEL)	TANK MAX. CONTENT (kg) FOR 3 min TEST	MINIMUM FLOW RATE (kg/min)
5A (one pump)	5	5A (either switch)	5,000	73
5A (both pumps)	5	5A (both switches)	5,000	95
5	1	5 left	500	320
5	2	5 right	500	259
6	1	6 left	500	249
6	2	6 right	500	310
7A (one pump)	7	7A (either switch)	5,000	81
7A (both pumps)	7	7A (both switches)	5,000	112
7	3	7 left	500	324
7	4	7 right	500	267
8	3	8 left	500	256
8	4	8 right	500	311

System Flow Test
Table 503

11. Interconnect Valve Flow Test

A. Prepare to Test Interconnect Valve Flow

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) For testing the left side valve ensure that tank 8 is empty and that tank 5 is full. For testing the right side valve ensure that tank 6 is empty and that tank 7 is full.

B. Test Interconnect Valve Flow

(1) On the fuel management panel set the INTER-CON valve switch to "OPEN". Observe the contents indicators for both associated tanks and check that the time taken for 1,000 kg of fuel to transfer is not greater than 4 min.

(2) Set the valve switch to "SHUT".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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TRANSFER SYSTEM TANK NOS.	ACCESS TO COMPONENTS			
	PUMPS (PANEL)	TRANSFER CONTROL VALVES (ZONE)	SENSORS (PANEL)	DE-AERATION (ZONE)
5 to 1	192 NB	524, between F50-54, inbd. wing, LH	523 CT	-
5 to 2	193 NB	-	526 BT	-
6 to 1	147 BB	524, between F50-51, outbd. wing, LH	523 CT	147, F60-66, fuselage
6 to 2	147 CB	526, between F63-66, inbd. wing, LH	526 BT	625, F56-60, wing, LH
7 to 3	196 BB 196 DB	525, between F61-62, inbd. wing, RH	626 BT	-
7 to 4	196 EB	524, between F50-51, outbd. wing, RH	623 CT	-
8 to 3	143 CB	524, between F50-54, inbd. wing, RH	626 BT	524, F50-56, wing, RH
8 to 4	143 BB	-	623 CT	143, F46-54, fuselage
5A to 5*	553 EB	-	-	527, F60-66, outer wing, LH
7A to 7*	653 EB	-	-	527, F60-66, outer wing, RH

NOTE: * Access to the transfer shut-off valves in transfer systems 5A to 5 and 7A to 7 is through panels 532 BT and 632 BT respectively.

Access to Components
Table 504

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MAIN TRANSFER SYSTEM - APPROVED REPAIRS

1. Repair Scheme K-28-40708

A. General

R NOTE: When manufacturing new pipes, L.56 is an
R approved alternative for AG.3 material.

The repair scheme contained in this topic applys to distorted pipes part numbers:

E 74.0402.002.00	E74.0521.003.00
E 74.0457.002.00	E74.0632.002.00
E 74.0490.002.00	E74.0633.000.00
E 74.0495.002.00	E74.0656.002.00
E 74.0517.003.00	E74.0828.002.00
E 74.0518.003.00	E74.0863.002.00
E 74.0519.001.00	

This repair scheme originates from British Airways R.S. K-28-40708.

B. Repair

Any of the above pipes found to be distorted from straight, but free from kinks and chafes, may be straightened out with the aid of cerrobend filler.

C. Conclusion

After repair, pipes must not deviate from straight by more than 0.2".

On completion ensure pipe is free of filler.

Mark repaired pipes with R.S. K-28-40708.

2. Repair Scheme 41272

A. General

R.S. 41272. Is applicable to Fuel Main Transfer Pipes. Zones 194-524 (IPC 28-22-10/20) (TIS28-62).

B. Repair

1. RS 41272 applies to all 1.25" and 1.50" dia. main transfer fuel pipes manufactured from AG3 and ASGM light alloys.

2. These pipes may be subjected to a once only removal of smooth dents, using standard practices, provided no individual dent is more than 0.25" deep, or extends

around more than a quarter of the pipe circumference, or encroaches within 0.50" of an end fitting.

3. Pipes with sharp edged dents and kinks may be repaired by welding provided the damaged area does not extend around more than a quarter of the pipe circumference, or is more than 2" in length, or encroaches within 1" of an end fitting.

<u>NOTE</u>: Welding Instructions Para 8.

4. On completion of repair, pipes should be subjected to dye penetrant crack detection, and to a pressure test of 100 psi.

5. Replace primer paint on exterior of pipe - as necessary - using barium chromate epoxy primer I.C.I. P/N F580-2022.

6. Renew dry lubricant coating on gamah couplings - as necessary - using Molykote X106 in accordance with MM 20-24-35.

7. On satisfactory completion of repair and testing, identify pipe with RS 28-41272 and date of repair adjacent to pipe part number.

8. Welding Repairs on AG3 and ASGM Pipes.

A. Strip paint from pipe.

B. Cut out damaged portion of pipe.

C. Make a patch from material of the same gauge as the original pipe and weld using Tungsten Inert Gas. Patch and welding rod specs to be as follows:-

BASIC PIPE MATERIAL	PATCH MATERIAL	FILLER ROD
AG3	L80*	BS2901/NG6 BS1453/NG6
ASGM	L113, L114*	BS2901/NG21 BS1453/NG21

* NOTE: A patch cut from an undamaged portion of a

R scrapped pipe of the same material spec as
R the pipe being repaired.

R D. Treat repaired area with brush alochrom 1200 in
R accordance with standard practices.

R Proceed with paragraphs 4 to 7.

SENSOR (TRANSFER CONTROL VALVE) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The sensors, comprising float-operated valves, are fitted two per support box in the associated collector tanks. Access to the sensors is gained by removing panels in the wing top surface.

2. Sensor (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-

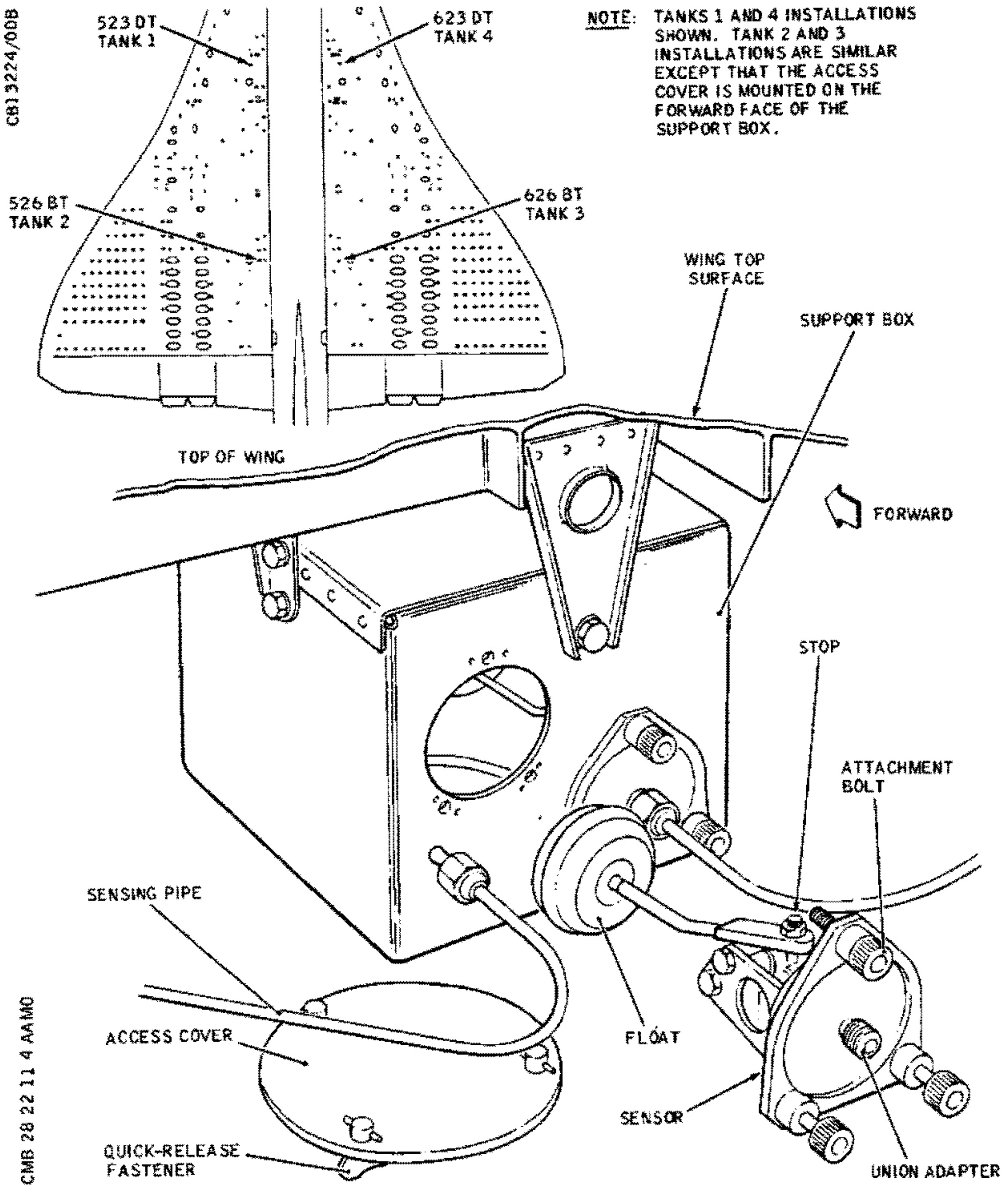
B. Prepare to Remove

(1) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

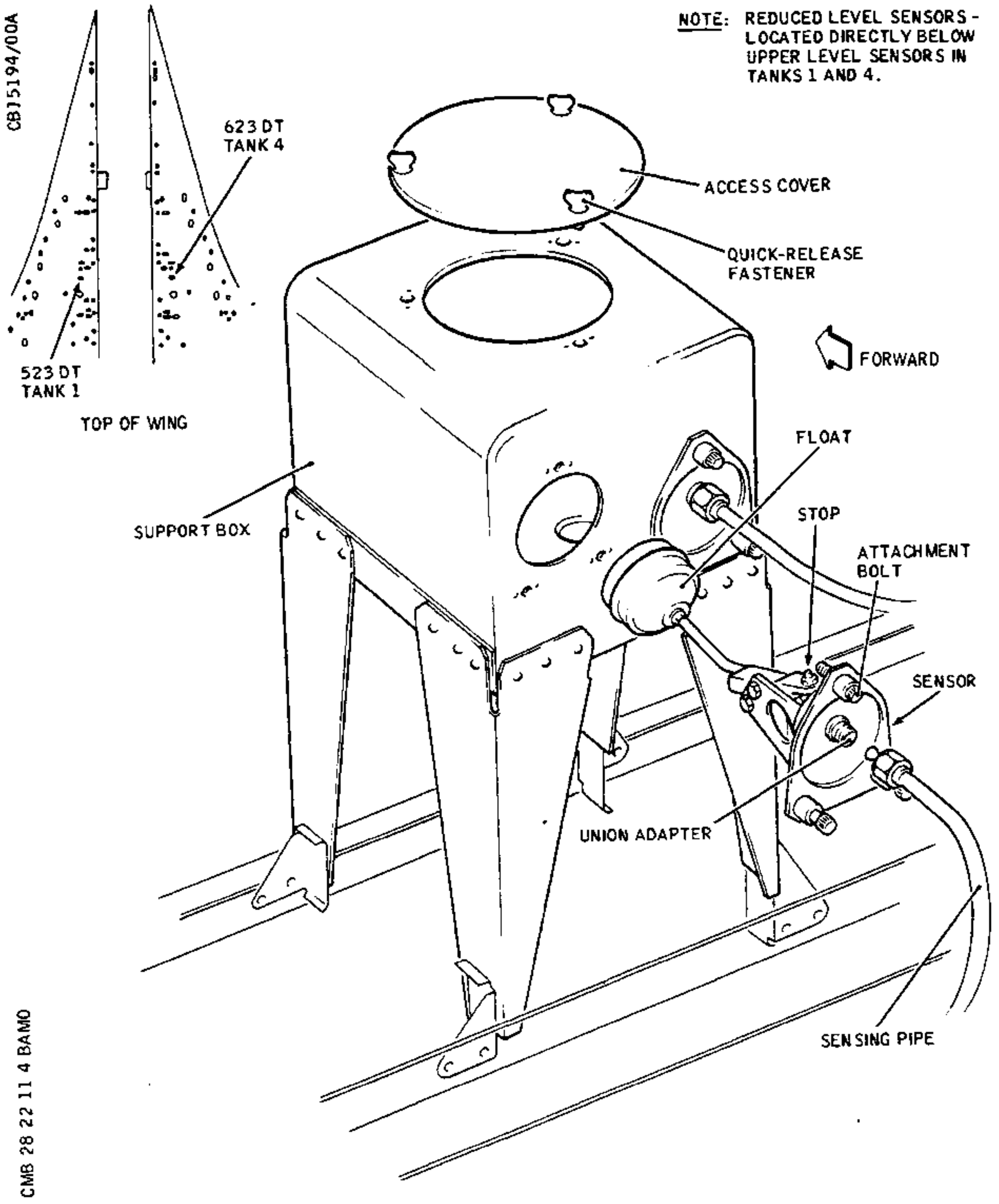
(2) Reduce the fuel in the tank to below support box level by transferring fuel (Ref. 28-00-00, Servicing) or by defuelling (Ref. 28-25-00).

(3) Remove the associated tank access panel (Ref. Fig.401 and 402).

(4) Electrically isolate the supply pumps which feed the tank and the refuel inlet valves by tripping the associated circuit breakers; fit safety clips.



R Upper Level Sensor - Installation
Figure 401



R Reduced Level Sensor - Installation
Figure 402

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 1			
TANK 5-1 PUMP SUP	4-213	Q905	D5
TANK 6-1 PUMP SUP	14-215	Q911	G17
R TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
Tank 2			
TANK 5-2 PUMP SUP	13-215	Q906	E19
TANK 6-2 PUMP SUP	13-216	Q912	F1
R TANK 2 REFUEL VALVE SUP	15-216	Q524	F2
Tank 3			
TANK 7-3 PUMP SUP	4-213	Q908	C8
TANK 8-3 PUMP SUP	13-215	Q910	G19
R TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
R SCAVENGE PUMP SUP	14-216	Q491	E4
R SCAVENGE PUMP CONT & IND	15-216	Q493	C6
Tank 4			
TANK 7-4 PUMP SUP	14-215	Q907	E17
TANK 8-4 PUMP SUP	14-216	Q909	D1
R TANK 4 REFUEL VALVE	15-215	Q521	E24

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R SUP			

R (5) Release the quick-release fasteners and remove the access cover from the support box.

C. Remove

(1) Unscrew the union nut and disconnect the sensing pipe. Fit suitable blanks to the pipe end and the union adapter.

(2) Support the float, unscrew the attachment bolts (captive), and withdraw the sensor by carefully manoeuvring the float through the hole in the support box.

D. Prepare to Install

R (1) Before installation, check the sensor float arm
R for full and free movement and ensure that the
R adjustable stop is wire-locked.

E. Install

(1) Comply with the electrical and fuel safety precautions.

(2) Carefully manoeuvre the float through the hole in the support box, then position and secure the sensor with the securing bolts. Temporarily tighten the bolts.

(3) Check that the float is unobstructed by manually operating the float arm over its full range of travel, then finally torque-tighten the sensor
R securing bolts to between 60 and 70 lbf in (0.678
R and 0.791 mdaN).

(4) Connect the sensing pipe to the union adapter. Torque-tighten the union nut to between
R 60 and 80 lbf in (0.678 and 0.904 mdaN).

F. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

R (2) Carry out a Leakage Test (Ref. Adjustment/Test).

R (3) Fit the access cover to the support box and secure the quick-release fasteners.

R (4) Fit the access panel to the fuel tank as detailed in 57-00-00, Removal/Installation.

R (5) Carry out a Functional Test of the sensor (Ref. Adjustment/Test).

SENSOR (TRANSFER CONTROL VALVE) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Twelve sensors, each comprising a float-operated valve, are fitted to support boxes in the collector tanks (1, 2, 3 and 4).

Two sensors, one at an upper level and one at a lower level, are contained in each support box.

Each collector tank has a support box mounted at the full fuel level, and tanks 1 and 4 each have an additional support box at a reduced fuel level.

Pump switches and fuel quantity indicators (FQIs), required for testing the sensors, are at the fuel management panel (3CM position).

The tank levels of each individual sensor, and its associated pump switch, are shown in Table 501.

R A Functional Test of a sensor and a Leakage Test of a sensor
R and associated piping are detailed in the following procedures. Operational and System Tests are not considered necessary in this application.

R SENSOR LOCATION (COLLECTOR TANK)	SENSOR LEVEL (COLLECTOR TANK)		ASSOCIATED PUMP SWITCH (MAIN TANK)
Tank 1	Full level	- upper	Tank 5 LH
		- lower	Tank 6 LH
	Reduced level	- upper	Tank 5 LH
		- lower	Tank 6 LH
Tank 2	Full level	- upper	Tank 5 RH
		- lower	Tank 6 RH
Tank 3	Full level	- upper	Tank 7 LH
		- lower	Tank 8 LH
Tank 4	Full level	- upper	Tank 7 RH
		- lower	Tank 8 RH

R	SENSOR LOCATION (COLLECTOR TANK)	SENSOR LEVEL (COLLECTOR TANK)	ASSOCIATED PUMP SWITCH (MAIN TANK)
		Reduced level - upper	Tank 7 RH
		- lower	Tank 8 RH

Sensor Levels in Tanks and Associated Pump Switches
Table 501

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Receptacle, for fuel, 50 gal (227 l)	-
Bonding lead, for receptacle	-

B. Prepare

WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT THE TRANSFER OF FUEL WITHOUT AIRCRAFT OVERBALANCE OCCURRING.

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00), that the aircraft is laterally level (0 deg roll) and longitudinally between level and 1 3/4 deg nose-up (between 0 and +1 3/4 deg pitch). Reposition the aircraft if necessary.

(2) Position a 50 gal (227 l) receptacle beneath the overflow/relief valve outlet in case of inadvertent fuel spillage. Electrically bond the receptacle to the aircraft.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the INTER-CON VALVE (6 to 7 and

5 to 8) switches are set to SHUT.

(5) Set the TANKS 1 and 4 NORM - AFT TRIM switch to "NORM", if testing a sensor positioned at full tank level, or to "AFT TRIM" if testing a sensor at the reduced tank level.

(6) Ensure that the collector tank, associated with the sensor under test, contains less fuel than the minimum control level as shown in Table 503. Transfer fuel or defuel (Ref. 28-25-00, Servicing) if necessary.

(7) Ensure that the main tank, associated with the collector tank of the sensor under test (Ref. Table 501), contains more than sufficient fuel to completely fill the collector tank. Transfer or refuel (Ref. 12-11-28) if necessary.

(8) Set the LIGHTS CTR switch on panel 6-214 to "TEST" and check that all captions on the fuel management panel are illuminated. Release the switch and check that the captions are extinguished.

C. Test

(1) Set the pump switch, associated with the sensor under test (Ref. Table 501), to "ON". Check that the LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(2) Check, by reference to the FQIs, that fuel is being transferred from the main tank to the collector tank at the correct flow rate (Ref. Table 502), indicating that the sensor valve is fully open.

	FUEL TRANSFER	MINIMUM FLOW RATE (kg/min)
R		
	Tank 5 to 1	320
	Tank 5 to 2	259
	Tank 6 to 1	249
R	Tank 6 to 2	320
	Tank 7 to 3	324
	Tank 7 to 4	267

R	FUEL TRANSFER	MINIMUM FLOW RATE (kg/min)
R	Tank 8 to 3	257
	Tank 8 to 4	311

Transfer Flow Rates
Table 502

(3) Check that the fuel transfer stops when the fuel quantity in the tank is within the control level range as shown in Table 503. If the fuel transfer does not stop at the high control level, set the pump switch to "OFF" and rectify the fault.

NOTE: A correction must be applied to the control level fuel quantity if the aircraft is not level (0 deg pitch and 0 deg roll). Table 503 shows the correction factor in kilogrammes for each 10 min of nose-up pitch (above 0 deg).

R R R	COLLECTOR TANK NO.	TANK FUEL CONTROL LEVELS (FQI)	CORRECTION FACTOR (FOR EACH 10 min PITCH ABOVE 0 deg)
	1 and 4 (AFT TRIM)	1,700 to 2,000 kg	Add 10 kg
	1 and 4 (NORMAL)	3,750 to 4,000 kg	Add 5 kg
	2 and 3	3,650 to 4,320 kg	Add 25 kg

Tank Fuel Control Levels
Table 503

(4) Maintain the pump selection at the ON position for 10 min and check that no further transfer occurs.

(5) If both sensors in one support box have been replaced, a check must be made to compare the collector tank control levels of each sensor, as follows:-

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(a) Transfer fuel from the associated main tank to the collector tank (Ref. Table 501), in accordance with Table 504, and check that the collector tank fuel quantity at CONTROL LEVEL A is at least 50 kg less than that at CONTROL LEVEL B.

CONTROL LEVEL A TRANSFER	CONTROL LEVEL B TRANSFER
From tank 6 to tank 1	From tank 5 to tank 1
From tank 6 to tank 2	From tank 5 to tank 2
From tank 8 to tank 3	From tank 7 to tank 3
From tank 8 to tank 4	From tank 7 to tank 4

Collector Tank Control Level Comparison
Table 504

(6) Set the pump switch to "OFF".

D. Conclusion

(1) Disconnect the bonding lead and remove the receptacle from the overflow/relief valve outlet.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 3. Leakage Test

R A. Equipment and Materials

DESCRIPTION	PART NO.
Nylon cord	-

R B. Prepare

R (1) Make available electrical ground power as detailed in 24-41-00.

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R (2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (3) Attach a placard to the management panel, indicating that the fuel system is being worked on and fuel system controls must not be operated.

R (4) Reduce the fuel level in the tank to below support box level by transferring fuel (Ref. 28-00-00, Servicing), or by defuelling (Ref. 28-25-00).

R (5) Ensure that the appropriate circuit breaker is set.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 1			
TANK 5-1 PUMP SUP	4-213	Q905	D5
TANK 6-1 PUMP SUP	14-215	Q911	G17
Tank 2			
TANK 5-2 PUMP SUP	13-215	Q906	E19
TANK 6-2 PUMP SUP	13-216	Q912	F1
Tank 3			
TANK 7-3 PUMP SUP	4-213	Q908	C8
TANK 8-3 PUMP SUP	13-215	Q910	G19
Tank 4			
TANK 7-4 PUMP SUP	14-215	Q907	E17
TANK 8-4 PUMP SUP	14-216	Q909	D1

(6) Ensure that the appropriate tank access panel is removed (Ref. Removal/Installation).

(7) Using the nylon cord, secure in the fully up position the float of the sensor under test (Ref. Table 501).

C. Test

(1) Set the associated pump switch (Ref. Table 501) to "ON". Check that its LOW PRESS caption is illuminated and then extinguished within 3 s.

(2) Slacken the cord securing the sensor float and allow fuel to spill from the sensor for 30 s. Then secure the sensor float in the fully up position with the nylon cord.

NOTE: This will bleed air from within the sensing pipes.

(3) With the pump still on, check, over a period of 5 min, that there are no fuel leaks either from the sensor or from the disturbed pipe connections.

(4) Return the pump switch to "OFF".

D. Conclusion

(1) Remove the nylon cord from the sensor float. Ensure that the float has full and free movement.

(2) Ensure that all equipment has been removed from the tank.

(3) Refit the access panel to the support box.

(4) Refit the tank access panel (Ref. Removal/Installation).

(5) Remove the placard from the fuel management panel.

(6) Refuel the tank (Ref. 12-11-28), as necessary.

(7) Switch off and disconnect electrical ground power as detailed in 24-41-00.

TRANSFER CONTROL VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-10-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

A transfer control valve, in association with a sensor control valve, regulates the transfer of fuel from one tank to another. Each transfer control valve consists of a valve element, housed in a valve body which is bolted to the underside of the tank roof. For the positions of the transfer control valves in the tanks and the tank panels through which access may be gained to them, refer to Table 401.

The transfer control valve body in tank 2 (6-2), and the forward transfer control valve body in tank 8 (8-4) each have an extra outlet and a filter associated with the de-aeration system (Ref. 28-13-00).

The following procedures deal separately with a valve element, a valve body without filter (tanks 5, 7 and 8), a valve body with filter (tanks 2 and 8), and a filter.

TANK	TRANSFER CONTROL VALVE	TANK ACCESS PANEL
2	Inboard	526 AB
5	Outboard	524 FT
	Forward	524 AB
	Aft	524 AB
7	Inboard	625 AB
8	Outboard	624 FT
	Forward	624 AB
	Aft	624 AB

Tank Access Panels
Table 401

2. Valve Element (Ref. Fig. 401)

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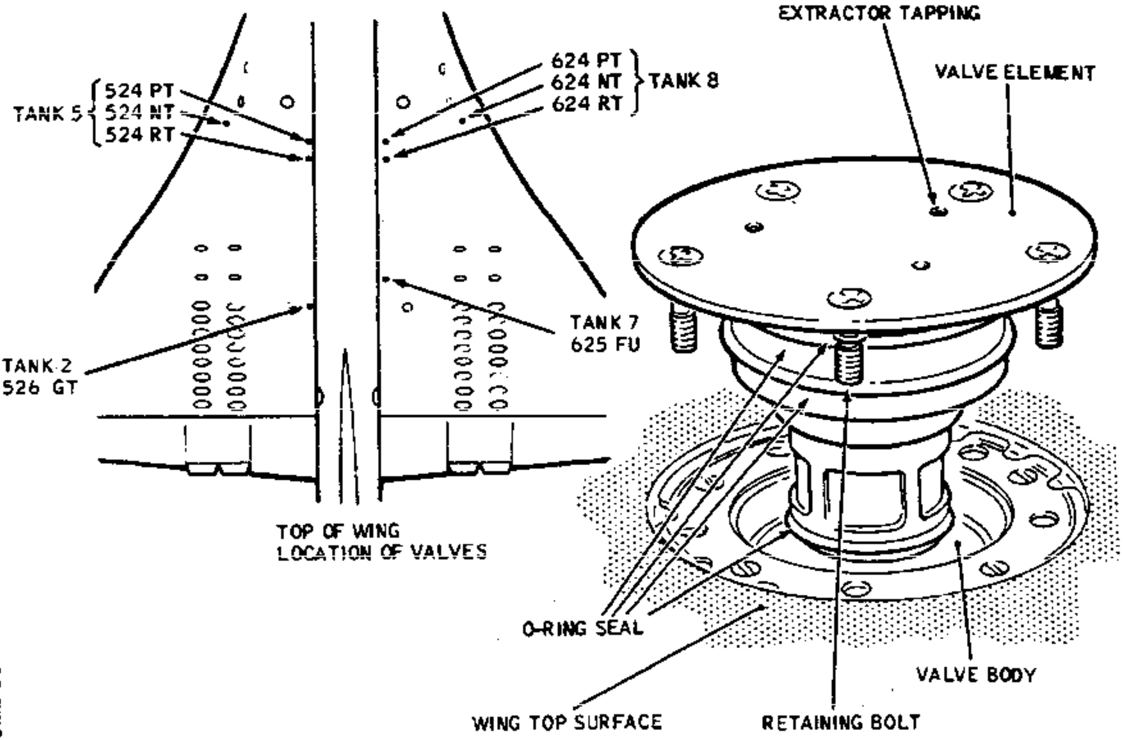

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- Transfer Control Valve Element - Installation
Before Service Bulletin 28-039
R Figure 401

A. Equipment and Materials

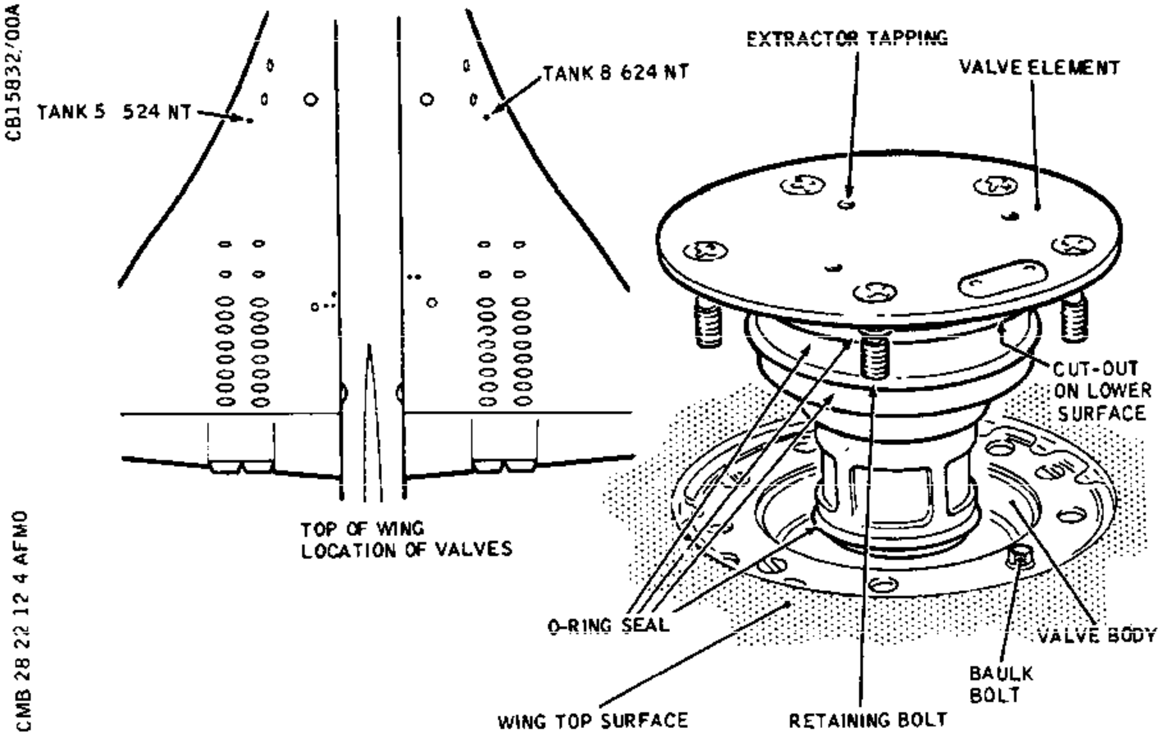
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 40 to 50 lbf in (0.45 to 0.57 mdaN)	-

B. Prepare

(1) Electrically isolate the associated transfer pumps by tripping the appropriate circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

**ON A/C ALL



- Transfer Control Valve Element - Installation
After Service Bulletin 28-039
Figure 402

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
No.2 tank valve			
TANK 6-2 PUMP SUP	13-216	Q912	F1
No.5 tank outboard valve			

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 6-1 PUMP SUP	14-215	Q911	G17
No.5 tank forward valve			
TANK 5-1 PUMP SUP	14-213	Q905	D5
No.5 tank aft valve			
TANK 5-2 PUMP SUP	13-215	Q906	E19
No.7 tank valve			
TANK 7-3 PUMP SUP	4-213	Q908	C8
No.8 tank outboard valve			
TANK 7-4 PUMP SUP	14-215	Q907	E17
No.8 tank forward valve			
TANK 8-4 PUMP SUP	14-216	Q909	D1
No.8 tank aft valve			
TANK 8-3 PUMP SUP	13-215	Q910	G19

C. Remove

(1) Ensure that the three extractor tappings in the top of the valve element are clean and free from obstruction, then fit a 10 UNF bolt into each tapping.

(2) Unscrew the retaining bolts. Lift on the extractor bolts and withdraw the element from the valve body. Remove the extractor bolts.

(3) Remove and discard the O-ring seals from the valve element and the retaining bolts.

(4) Fit a suitable blank over the valve body.

D. Install

NOTE: New O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals to the valve body and the retaining bolts.

(3) Remove the blank from the valve body.

Before SB 28-038

(4) Position and secure the element in the valve body with the retaining bolts. Torque-tighten the bolts to between 40 and 50 lbf in (0.45 and 0.57 mdaN).

After SB 28-039 For A/C 001-005,

(4) Position the element in the valve body. Ensure that, for the outboard element of tanks 5 and 8, the cut-out in the flange fits over the baulk bolt. Secure the element with the bolts, torque-tightening them to between 40 and 50 lbf in (0.45 and 0.57 mdaN).

E. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the valve element (Ref. Adjustment/Test).

3. Valve Body (without Filter) - Tanks 5 and 7, and Tank 8 (Rear and Outboard) (Ref. Fig.403 and 404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 110 to 120 lbf in (1.243 to 1.356 mdaN)	-

DESCRIPTION	PART NO.
Torque spanner, 107 to 117 lbf in (1.209 to 1.332 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
Torque spanner, 30 to 40 lbf in (0.339 to 0.452 mdaN)	-

R After SB 28-018 For A/C 001-005,

R Sealant tools for removal/ application of sealants, (Ref. 28-11-00, Approved Repairs - Sealants)	-
R Sealants etc.	-
R PR1720R (Ref. 20-30-00, No.390)	
R PR1720SM (Ref. 20-30-00, No.351)	-
R PR1720F (Ref. 20-30-00, No.352)	-
R Cyclohexanone, for use with product No.390	-
R Cleaning solvents	-
R Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
R Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
R Halogenated hydrocarbon solvent R113 (Ref. 20-30-00, No.484)	-

DESCRIPTION	PART NO.
RB Eurotwill cloth	-

B. Prepare

(1) Drain the fuel tank (Ref. 28-25-00), then remove the tank access panel (Ref. Table 401).

(2) Remove the transfer control valve element (Ref. para.2.).

C. Remove

(1) Unscrew the union nut and disconnect the sensing pipe. Fit suitable blanks to the union nut and elbow adapter.

NOTE: Adjustable support rods are fitted to the elbow pipes at tank 8 outboard transfer control valve and tank 5 outboard transfer control valve.

(2) If applicable, remove the nut and bolt and disconnect the adjustable support rod at the elbow.

(3) Disconnect the bonding lead from the lug on the valve body.

(4) Disconnect the bonding lead bridging each elbow-to-transfer-pipe joint, then lift the locking clip, unscrew the joint nut and disconnect the transfer pipe from the elbow.

(5) If applicable, remove the bolts and washers securing the support plate to the mounting bracket. Note the position of the special earthing bolt.

(6) Remove and discard the O-ring seals, then fit suitable blanks to the transfer pipe ends.

Before SB 28-018

(7) Support the valve body inside the tank, then from the top of the tank remove the retaining bolts and the clamping ring and withdraw the valve

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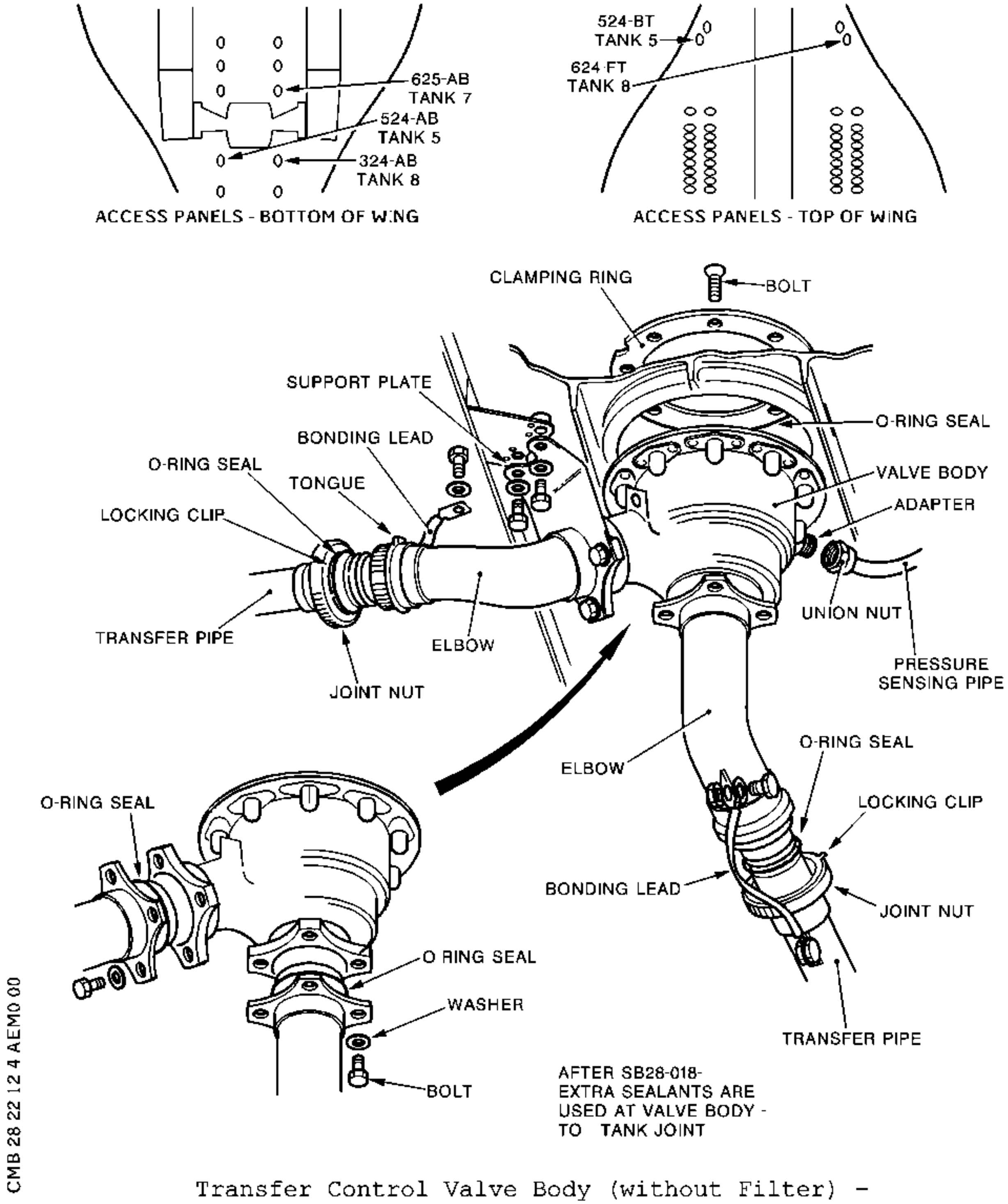

Transfer Control Valve Body (without Filter) -
Typical Installation
Figure 403

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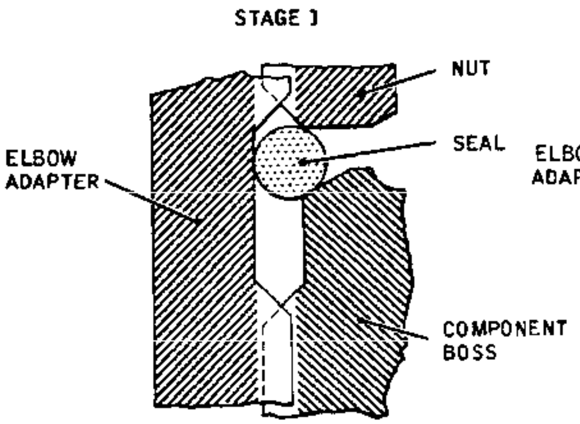
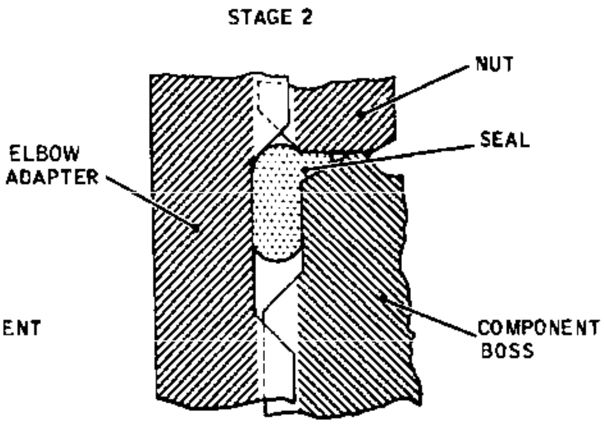




STAGE 1

1. Assemble nut on adapter until bottom face of nut aligns with upper corner of seal groove in adapter.

2. Lubricate seal in accordance with 20-23-11 and fit to seal groove in adapter.

3. Simultaneously screw adapter and nut into boss until seal contacts boss chamfer.

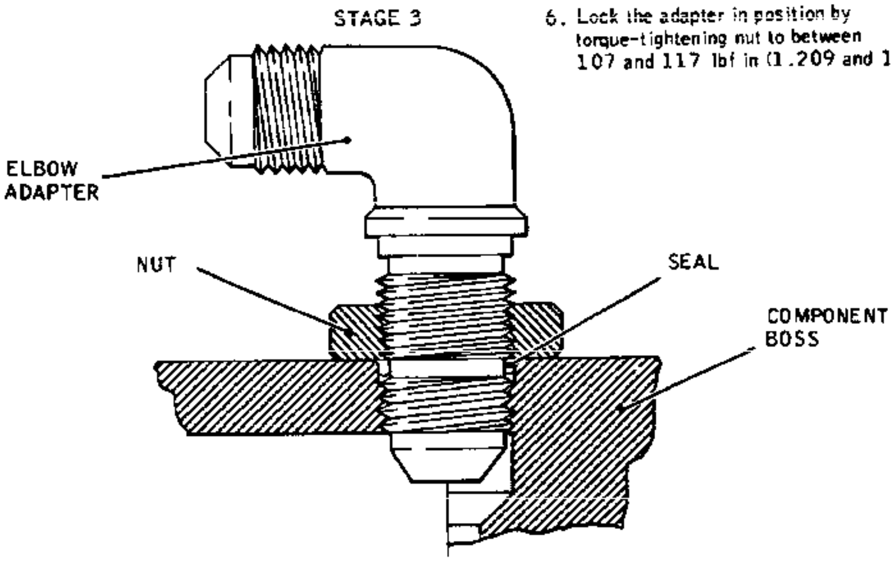
STAGE 2

4. Continue to screw adapter and nut into boss until nut face contacts boss.

5. Position the elbow adapter to suit the particular pipeline installation by either screwing the adapter further in 3/4 turn (+270°) or by unscrewing the adapter 1/4 turn (-90°).

STAGE 3

6. Lock the adapter in position by torque-tightening nut to between 107 and 117 lbf in (1.209 and 1.322 mdaN).



ADAPTER INSTALLED

CMB 28 22 12 4 CAMO

\- Sensing Pipe - Adapter Installation
Figure 404

body, complete with elbows, from inside the tank.

R After SB 28-018 For A/C 001-005,

R WARNING: SOLVENTS 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC;
R R.113 IS TOXIC.

R TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS
R WHEN USING CLEANING SOLVENTS.

R (7) Remove the valve body as follows:-

R (a) Support the valve body inside the tank, then
R from the top of the tank remove the retaining
R bolts and clamping ring.

R (b) Using the sealant cutting tool and solvents,
R carefully separate the valve body from the tank.

R (c) Remove the valve body, complete with elbows,
R from the tank.

R (d) Thoroughly clean off any remaining sealants.

(8) Detach the elbows from the valve body by removing the securing bolts. Note the position of the special earthing bolts at each bonding position.

(9) Remove and discard the O-ring seals from each elbow flange and from the valve body flange.

D. Install

NOTE: New O-ring seals must be lubricated in accordance with 20-23-11 before installation.

Earthing bolts must be fitted to their bonding positions as noted during removal.

Bonding must be checked in accordance with 20-27-11.

The countersunk side of the bolt washers must fit against the underside of the bolt head.

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals to the inlet and outlet elbow flanges. Ensure that the elbow is orientated as

noted during dismantling and assemble the outlet elbow with its support plate to the valve body with the bolts and washers. Align and fit the inlet elbow to the valve body. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 to 1.356 mdaN).

(3) Assemble the sensing pipe elbow adapters for the valve bodies in tank 5 (rear) (5-2) and tank 8 (rear) (8-3) as detailed in the illustration (Ref. Fig. 404).

(4) Assemble the straight sensing pipe adapter to the valve body, with a new O-ring seal, lubricated in accordance with 20-23-11, fitted to the underside of the adapter. Hand-tighten the adapter to the valve body. Torque-tighten the adapter to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

R Before SB 28-018

Before SB 28-039

(5) Fit a new O-ring seal in the groove in the valve body flange, then position the valve body inside the tank, aligning it with the transfer pipes and the pressure sensing pipe, and secure it with the clamping ring and the retaining bolts. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

After SB 28-039 For A/C 001-005,

(5) Fit a new O-ring seal in the groove in the valve body flange; then position the valve body inside the tank and align it with the transfer pipes and the pressure sensing pipe. Secure the outboard valve body of tanks 5 and 8 with the clamping ring, the retaining bolts and, in the most inboard bolt-hole, the baulk bolt. Secure the remaining valve bodies with the clamping ring and retaining bolts only. Torque-tighten all bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

R After SB 28-018 For A/C 001-005,

R (5) Install the valve body as follows:-

R (a) Fit a new, dry O-ring seal to the groove in the

R valve body.

R (b) Apply sealant PR1720R (prefabricated tape) or
R PR1720SM (semi-paste/fluid) to the mating face
R of the valve body in accordance with 20-22-12.

R (c) Position the valve body inside the tank and
R align it with the transfer pipes and pressure
R sensing pipe.

R (d) Secure the outboard valve body of tanks 5 and 8
R with the clamping ring, the retaining bolts and,
R in the most inboard bolt-hole, the baulk bolt.
R Secure the remaining valve bodies with the clamp-
R ing ring and retaining bolts only.

R (e) Torque-tighten all bolts to between 110 and
R 120 lbf in (1.243 and 1.356 mdaN).

R (f) Using sealant PR1720F (thick thixotropic paste)
R in accordance with 20-22-12, encapsulate the
R valve body anchor nuts, allow the sealant to
R become tack-free, then apply an overcoating of
R sealant PR1720SM to the valve body anchor nuts.

(6) Secure the support plate to the mounting bracket with the bolts and washers. Torque-tighten the bolts to between 30 and 40 lbf in (0.339 to 0.452 mdaN).

(7) Fit a new O-ring seal in the groove in each transfer pipe, then connect the transfer pipes to the elbows. Tighten each joint nut by hand until the nut abuts the elbow flange and the locking clip engages the tongue, in accordance with 20-23-21.

(8) Connect the bonding lead at each transfer-pipe-to-elbow joint with the bolts and washers. Torque-tighten the bolts to between 30 and 40 lbf in (0.339 and 0.452 mdaN). Check the bonding in accordance with 20-27-11.

(9) If applicable, connect and secure the adjustable rod to the elbow with the nut and bolt. Ensure that the rod does not strain the elbow; if necessary, adjust the length of the rod as required. Torque-tighten the securing nut to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(10) If applicable, connect the bonding lead to the lug

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on the valve body and check the bonding in accordance with 20-27-11.

(11) Remove the blank and connect the pressure sensing pipe. Torque-tighten the union nut to between 60 and 80 lbf in (0.68 and 0.90 mdaN).

E. Conclusion

(1) Install the transfer valve element (Ref. para.2.D.).

(2) Remove the safety clip and reset the circuit breakers tripped before removal.

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(3) Carry out a Leakage Test of the valve body (Ref. Adjustment/Test).

(4) Ensure that the bonding surface of the access panel, clamp ring and the wing surface are clean and lightly coated with Aeroshell Grease No.16, DTD 900/4841.

R (5) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (6) Fit the tank access panel.

R (7) Refuel the tank (Ref. 12-11-28).

R (8) Carry out a Functional Test of the valve element (Ref. Adjustment/Test).

4. Valve Body (with Filter) - Tank 2 and Tank 8 (Forward) (Ref. Fig. 404, 405 and 406)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Grease (Ref. 20-30-00, No.54)	-
Torque spanner, 110 to 120 lbf in (1.243 to 1.356 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.332 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN).	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.940 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 30 to 40 lbf in (0.339 to 0.452 mdaN).	-
After SB 28-018 For A/C 001-005,	
Sealant tools for removal/application of sealants, (Ref. 28-11-00, Approved Repairs - Sealants)	-
Sealants etc.	-
PR1720R (Ref. 20-30-00, No.390)	-
PR1720SM (Ref. 20-30-00, No.351)	-
PR1720F (Ref. 20-30-00, No.352)	-
Cyclohexanone, for use with sealant PR1720R	-
Cleaning solvents	-
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
Halogenated hydrocarbon solvent R.113 (Ref. 20-30-00, No.484)	-
RB Eurotwill cloth	-

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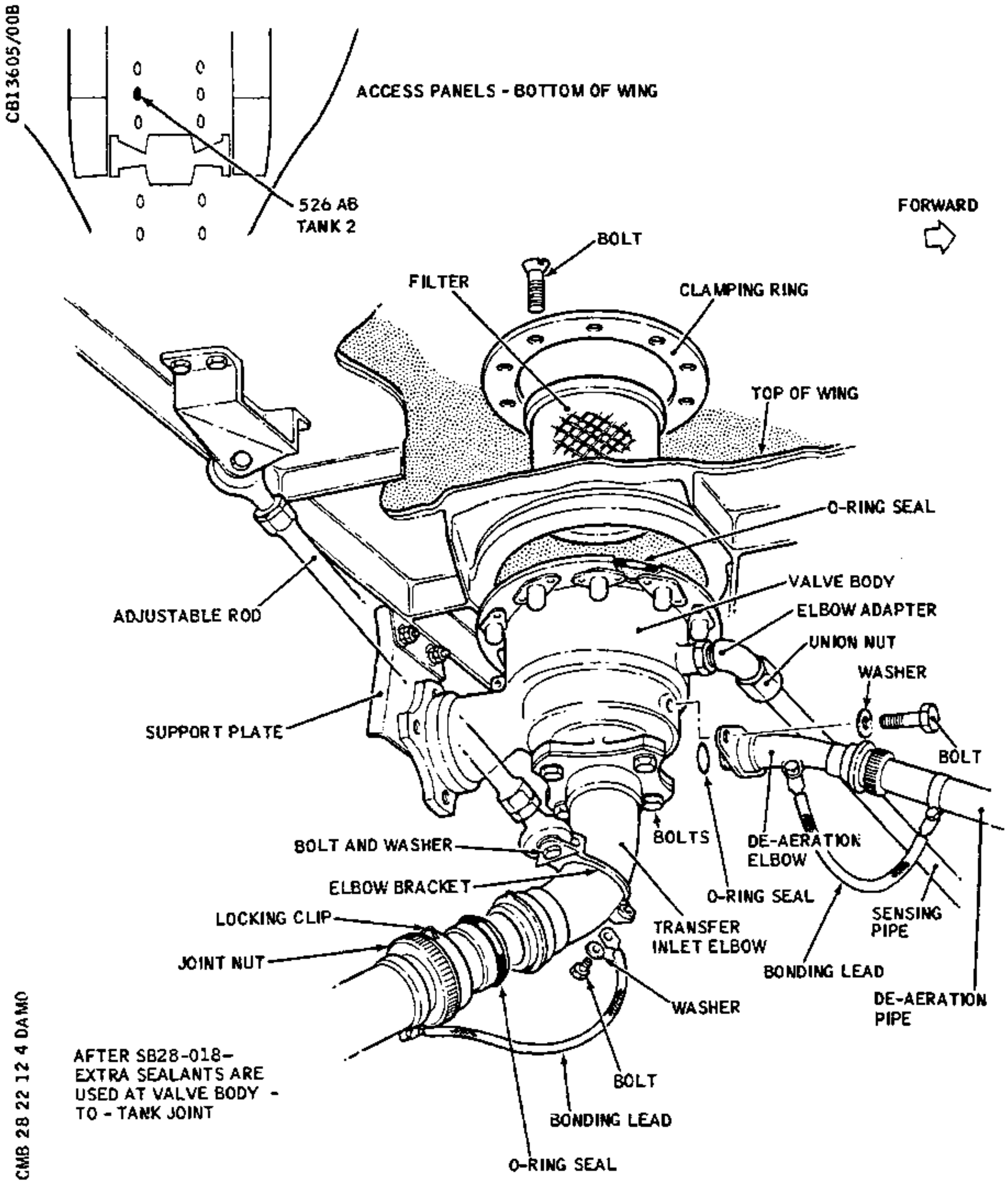
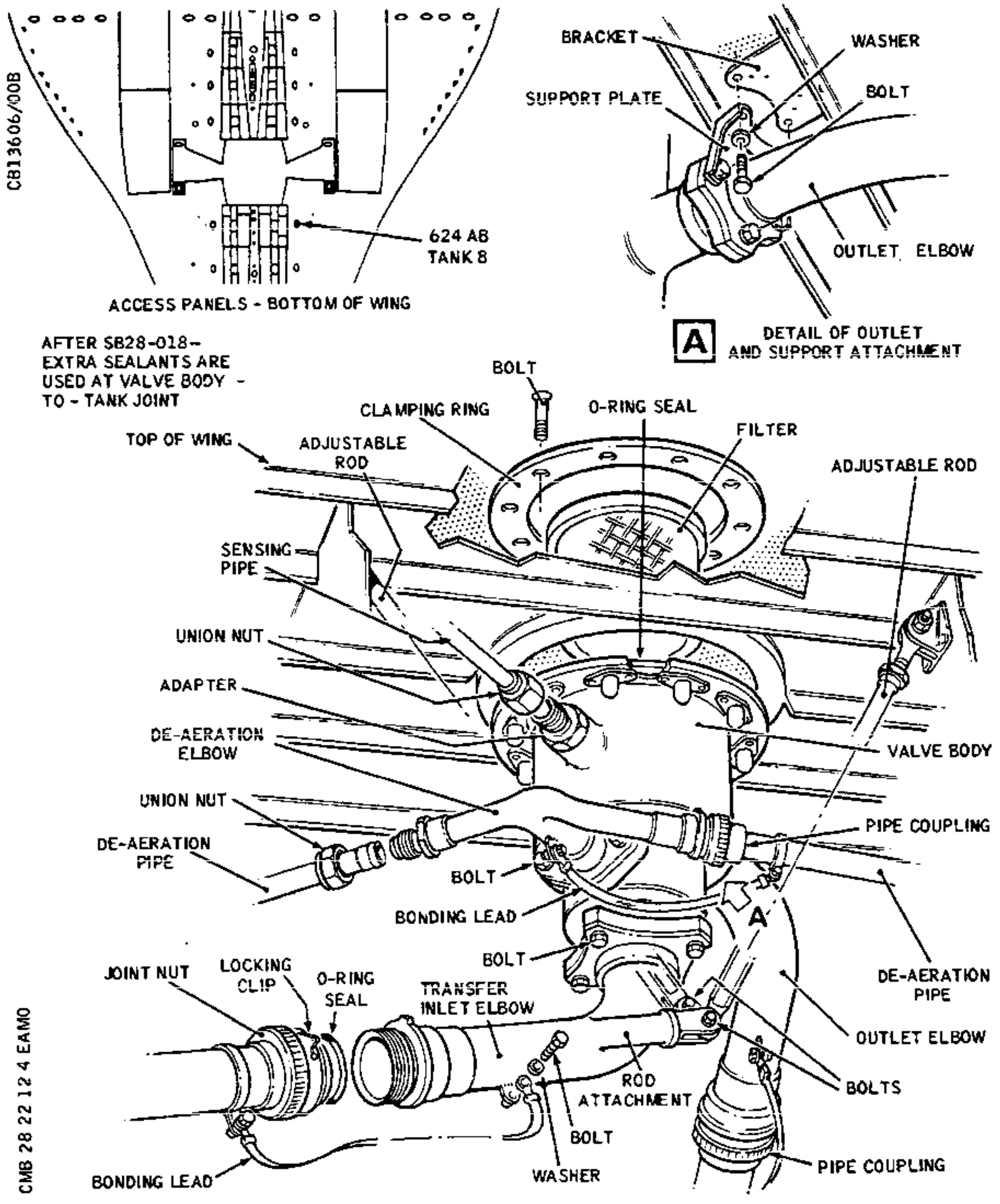


\- Transfer Control Valve Body
(with Filter) in Tank 2 - Installation
Figure 405

R



\- Transfer Control Valve Body
(with Filter) in Tank 8 - Installation
R Figure 406

B. Prepare

(1) Defuel the appropriate fuel tank (Ref. 28-25-00).

(2) Remove the transfer control valve element (Ref. para.2.).

(3) Remove the tank access panel (Ref. Table 401).

C. Remove

(1) Unscrew the union nut from the sensing pipe adapter. Fit suitable blanks to the sensing pipe and the adapter.

(2) Disconnect the bonding lead from the de-aeration elbow, lift the locking clip and unscrew the joint nut to disconnect the de-aeration pipe from the elbow. Remove and discard the O-ring seal and fit suitable blanks to the pipe and elbow.

NOTE: Tank 8 de-aeration elbow is a T-type elbow and has two pipes fitted to it.

(3) Disconnect the bonding lead from the transfer inlet elbow (on the tank 8 installation, also the outlet elbow); lift the locking clip and unscrew the joint nut. Disconnect the transfer pipe from the elbow. Remove and discard the O-ring seal and fit suitable blanks to the pipe and elbow.

(4) Support the valve body and remove the bolt and washer securing the adjustable rod to the inlet pipe elbow. Move the rod clear of the valve body.

NOTE: The tank 8 installation has two adjustable rods attached at the elbow and these are secured by self-locking nuts and bolts.

(5) Remove the two bolts and washers securing the support plate to the support bracket.

(6) Remove the bolts securing the valve body and clamping ring at the top of the tank.

R Before SB 28-018

(7) Remove the valve body from the tank.

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R After SB 28-018 For A/C 001-005,

R WARNING: SOLVENTS 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC;
R R.113 IS TOXIC.

R TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS
R WHEN USING CLEANING SOLVENTS.

R (7) Remove the valve body as follows:-

R (a) Using the sealant cutting tool and solvents,
R carefully separate the valve body from the tank.

R (b) Remove the valve body from the tank.

R (c) Thoroughly clean off any remaining sealants.

(8) Note the orientation of the elbows on the valve body and note the position of the special earthing bolts at each bonding position.

(9) Disconnect and remove the de-aeration, transfer inlet, (on tank 8 valve, the transfer outlet), and sensing pipe adapters from the body. Remove and discard the O-ring seals from the elbows and body flange.

(10) Remove the support plate from the valve body outlet.

D. Install

NOTE: All O-ring seals must be lubricated in accordance with 20-23-11 before installation.

Earthing bolts must be fitted to their bonding positions as noted during removal, and bonding checked in accordance with 20-27-11.

The countersunk side of the bolt washers must fit against the underside of the bolt head.

(1) Comply with the fuel and electrical safety precautions.

(2) On the tank 2 valve body :-

(a) Fit a new O-ring seal to the sensing pipe elbow adapter.

(b) Assemble the elbow adapter to the valve body as detailed in the illustration (Ref. Fig. 404).

Ensure that the elbow is orientated as noted during removal.

(3) On the tank 8 valve body:-

(a) Fit a new O-ring seal to the sensing pipe adapter.

(b) Fit the adapter to the valve body and torque-tighten it to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(4) On the tank 2 valve body :-

(a) Assemble the support plate to the valve body outlet with the bolts and washers.

(b) Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

(5) Fit a new O-ring seal to the transfer inlet elbow. Place the elbow in position, ensuring that the elbow is orientated as noted during removal. Secure the elbow to the valve body with the bolts and washers. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

(6) On the tank 8 valve body :-

(a) Fit a new O-ring seal to the outlet elbow.

(b) Place the elbow in position, ensuring that it is orientated as noted during dismantling.

(c) Secure the elbow and support plate to the valve body with the bolts and washers. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

(7) Fit a new O-ring seal to the de-aeration elbow. Place the elbow in position, ensuring that it is orientated as noted during removal. Secure the elbow to the valve body with the bolts and washers. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

(8) Ensure that the filter is in position at the bottom of the valve body.

R Before SB 28-018

(9) Fit a new O-ring seal to the groove in the valve body flange. Position the valve body in the tank by aligning the support plate with the mounting bracket in the tank roof.

R After SB 28-018 For A/C 001-005,

R (9) Install the valve body as follows:-

R (a) Fit a new, dry O-ring seal to the groove in the
R valve body.

R (b) Apply sealant PR1720R (prefabricated tape) or
R PR1720SM (semi-paste/fluid) to the mating
R face of the valve body in accordance with
R 20-22-12.

R (c) Position the valve body in the tank by aligning
R the support plate with the mounting bracket in
R the tank roof.

R Before SB 28-018

(10) Secure the valve body to the top of the tank with the clamping ring and bolts. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 and 1.356 mdaN).

R After SB 28-018 For A/C 001-005,

R (10) Secure the valve body as follows:-

R (a) Secure the valve body to the top of the tank
R with the clamping ring and bolts. Torque-
R tighten the bolts to between 110 and 120 lbf in
R (1.243 and 1.356 mdaN).

R (b) Using sealant PR1720F (thick thixotropic paste)
R in accordance with 20-22-12, encapsulate the
R valve body anchor nuts, allow the sealant to
R become tack-free, then apply an overcoating of
R sealant PR1720SM to the valve body anchor nuts.

(11) Secure the support plate to the mounting bracket with the bolts and washers. Torque-tighten the bolts to between 30 and 40 lbf in (0.339 and 0.452 mdaN).

(12) Connect the pressure sensing pipe to the sensing

pipe adapter. Torque-tighten the union nut to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(13) Fit a new O-ring seal to the de-aeration and transfer pipe couplings. Connect the de-aeration and transfer pipe couplings to their respective elbows in accordance with 20-23-21. On tank 8 de-aeration elbow only, connect the union nut to the elbow and torque-tighten it to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(14) Connect the bonding leads across the de-aeration and transfer pipe couplings with the bolts and washers. Torque-tighten the bolts to between 30 and 40 lbf in (0.339 and 0.452 mdaN). Check the bonding in accordance with 20-27-11.

(15) On the tank 2 valve body:

(a) Fit the adjustable rod to the elbow bracket with the bolt and washer. Torque-tighten the bolt to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(16) On the tank 8 valve body:

(a) Fit the adjustable rods to the elbow bracket with the self-locking nuts and bolts. Torque-tighten the nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

E. Conclusion

(1) Install the transfer valve element (Ref. para.2.D.).

(2) Remove the safety clips and reset the circuit breakers tripped before removal.

(3) Carry out a Leakage Test of the valve body (Ref. Adjustment/Test).

(4) Ensure that the bonding surface of the access panel, clamp ring and wing surface are clean and lightly coated with Aeroshell Grease No.16, DTD 900/4841.

R (5) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

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R (6) Fit the tank access panel.

R (7) Refuel the tank (Ref. 12-11-28).

R (8) Carry out a Functional Test of the valve element (Ref. Adjustment/Test).

5. De-aeration Filter (Tank 2 and Tank 8, Forward)
(Ref. Fig. 405 and 406)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Remove the appropriate transfer control valve element (Ref. para.2.).

C. Remove

(1) Lift the filter from the base of the valve body.

(2) Check the filter for debris and damage.

(3) If necessary clean the filter as detailed in 28-13-16, Cleaning/Painting.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Fit the filter to the base of the valve body, ensuring that the filter is located by its beaded rim in the recess provided in the valve body.

E. Conclusion

(1) Refit the appropriate transfer control valve element (Ref. para.2.).

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TRANSFER CONTROL VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

A transfer control valve, in association with a sensor valve (Ref. 28-22-11), regulates the transfer of fuel from one tank to another. Each transfer control valve consists of a valve element, housed in a valve body which is bolted to the underside of the tank roof.

R For the positions of the transfer control valves in the tanks,
R their associated fuel transfer tanks and the associated pump switches at the fuel management panel (3CM position), refer to Table 501.

For the valve element locations, refer to Removal/Installation.

Controls and indicators required for testing a transfer control valve are at the fuel management panel.

The following procedure comprises a Functional Test of the transfer control valve and Leakage Tests of the valve body in the various locations. Operational and System Tests are not considered necessary in this application.

TRANSFER CONTROL VALVE LOCATION		ASSOCIATED FUEL TRANSFER	ASSOCIATED PUMP SWITCH (3CM)
TANK NO.	POSITION IN TANK		
Tank 2	Inboard	Tank 6 to 2	Tank 6 RH
Tank 5	Outboard	Tank 6 to 1	Tank 6 LH
Tank 5	Inboard, forward	Tank 5 to 1	Tank 5 LH
Tank 5	Inboard, aft	Tank 5 to 2	Tank 5 RH
Tank 7	Inboard	Tank 7 to 3	Tank 7 LH
Tank 8	Outboard	Tank 7 to 4	Tank 7 RH
Tank 8	Inboard, forward	Tank 8 to 4	Tank 8 RH

TRANSFER CONTROL VALVE LOCATION TANK NO.	POSITION IN TANK	ASSOCIATED FUEL TRANSFER	ASSOCIATED PUMP SWITCH (3CM)
Tank 8	Inboard, aft	Tank 8 to 3	Tank 8 LH

Transfer Control Valve Location and Associated Fuel Transfer
Table 501

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Receptacle, 50 gal (227 l)	-
Bonding lead, for receptacle	-

WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT THE TRANSFER OF FUEL WITHOUT AIRCRAFT OVERBALANCE OCCURRING.

B. Prepare

(1) Ensure, by reference to the aircraft attitude R indicator (Ref. 28-11-00, Description and Operation), that the aircraft is laterally level (0 deg roll) and longitudinally between level and 1 3/4 deg nose up (0 and +1 3/4 deg pitch). Reposition the aircraft if necessary.

(2) Position a 50 gal (227 l) receptacle beneath the overflow/relief valve outlet in case of inadvertent fuel spillage. Electrically bond the receptacle to the aircraft.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing), the INTER-CON VALVE (6 to 7 and 5 to 8) switches are set to SHUT and the TANKS 1 and 4 NORM -

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AFT TRIM switch is set to NORM.

(5) Ensure that the collector tank, associated with the transfer control valve under test, contains less than 500 kg of fuel. Defuel (Ref. 28-25-00, Servicing) if necessary.

(6) Ensure that the main tank, associated with the transfer control valve under test, contains at least 5,000 kg of fuel. Transfer fuel or refuel (Ref. 12-11-28) if necessary.

(7) Set the LIGHTS CTR switch on panel 6-214 to "TEST" and check that all captions on the fuel management panel are illuminated. Release the switch and check that the captions are extinguished.

C. Test

(1) Record, by reference to the fuel quantity indicators (FQIs), the quantities of fuel in the tanks associated with the transfer (Ref. Table 501).

(2) Set the pump switch, associated with the transfer control valve under test (Ref. Table 501), to "ON". Check that the LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(3) Check, by reference to the FQIs, that the fuel transfer flow rate, for a minimum period of 3 min, is in accordance with Table 502.

	FUEL TRANSFER	MINIMUM FLOW RATE (kg/min)	HIGH CONTROL LEVEL (kg)
R R			
	Tank 5 to 1	320	3,750 to 4,000
	Tank 5 to 2	259	3,650 to 4,320
	Tank 6 to 1	249	3,750 to 4,000
R	Tank 6 to 2	320	3,650 to 4,320
	Tank 7 to 3	324	3,650 to 4,320
	Tank 7 to 4	267	3,750 to 4,000
R	Tank 8 to 3	257	3,650 to 4,320

R	FUEL TRANSFER	MINIMUM FLOW RATE (kg/min)	HIGH CONTROL LEVEL (kg)
	Tank 8 to 4	311	3,750 to 4,000

Transfer Flow Rates
Table 502

(4) Check that the fuel transfer stops when the fuel quantity in the collector tank reaches the high control level. If the fuel transfer does not stop, set the pump switch to "OFF" and rectify the fault.

NOTE: A correction must be applied to the control level fuel quantity if the aircraft is not level (0 deg pitch and 0 deg roll). Table 503 shows the correction factor in kilogrammes for each 10 min of nose-up pitch (above 0 deg).

R	COLLECTOR TANK NO.	CORRECTION FACTOR (FOR EACH 10 min PITCH ABOVE 0 deg)
	1 and 4 (NORMAL)	Add 5 kg
	2 and 3	Add 25 kg

Correction Factor
Table 503

(5) Maintain the pump selection at the "ON" position for 10 min and check that no further transfer occurs. Check also that there is no fuel leakage from the transfer control valve element on the top surface of the wing.

(6) Set the pump switch to "OFF".

D. Conclusion

(1) Disconnect the bonding lead and remove the receptacle

from the overflow/relief valve outlet.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test - Tank 2 Valve

A. Prepare

NOTE: Tank 2 valve controls fuel transfer from tank 6 to tank 2.

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that tank 6 contains at least 1,500 kg of fuel for the test. Refuel (Ref. 12-11-28) if necessary.

(3) Defuel and drain (Ref. 28-25-00, Servicing) tank 2.

(4) Check that the refuel control panel access door is closed.

(5) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(6) Open tank 2 access panel 526 AB.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(7) Enter the tank and raise the lower sensor float arm in the support box (Ref. 28-22-11, Removal/Installation). Support the float arm in this position, using nylon cord.

NOTE: The foregoing action will prevent fuel flowing into tank 2 during the test.

B. Test

(1) At the fuel management panel, set tank 6 RH PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated, and then extinguished after 3 s as pump pressure builds up.

(2) Check, during a period of 3 min, that there is no fuel leakage from the pipe-to-valve and valve-to-tank

joints.

(3) Set the PUMP switch to "OFF".

C. Conclusion

(1) Remove the nylon cord and release the sensor float arm.

(2) Refit the tank access panel.

(3) Refuel the tank (Ref. 12-11-28). Check that there is no fuel leakage from the access panel joint.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test - Tank 5 or 8 Outboard Valve

A. Prepare

NOTE: Tank 5 outboard valve controls fuel transfer from tank 6 to tank 1. Tank 8 outboard valve controls fuel tranfer from tank 7 to tank 4.

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that the appropriate tank (6 or 7) contains at least 1,500 kg of fuel for the test. Refuel (Ref. 12-11-28) if necessary.

(3) Defuel and drain (Ref. 28-25-00, Servicing) the tank (5 or 8) in which the valve is fitted.

(4) Ensure that the receiving tank (1 or 4) has the the capacity to receive 1,500 kg of fuel during the test. Defuel (Ref. 28-25-00, Servicing) if necessary.

(5) Check that the refuel control panel access door is closed.

(6) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(7) Open the appropriate tank access panel in the

wing top surface (524 BT for tank 5 or 624 BT for tank 8).

B. Test

(1) At the fuel management panel, set the appropriate PUMP switch (tank 6 LH for tank 6-1 transfer; tank 7 RH for tank 7-4 transfer) to "ON". Check that the LOW PRESS caption is illuminated, and then extinguished after 3 s as pump pressure builds up.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(2) Observe the valve through the aperture in the wing top surface and check, during a 3 min period of fuel transfer, that there is no fuel leakage from the pipes-to-valve and valve-to-tank joints.

(3) Set the PUMP switch to "OFF".

C. Conclusion

(1) Refit the tank access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. Leakage Test - Tank 5 Inboard Valve

A. Prepare

NOTE: Tank 5 inboard, forward valve controls fuel transfer from tank 5 to tank 1. Tank 5 inboard, aft valve controls fuel transfer from tank 5 to tank 2.

(1) Check, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft is positioned in the nominal ground attitude. Reposition the aircraft if necessary.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Refuel (Ref. 12-11-28) or defuel (Ref. 28-25-00, Servicing) tank 5 to achieve a fuel level which is the lowest that can be effectively read on the magnetic level indicator (Ref. 28-11-00, Description and Operation). Check this fuel quantity

(approximately 1,000 kg) also by reference to the fuel quantity indicator on the fuel management panel.

(4) Ensure that the receiving tank (1 or 2) has the the capacity to receive 1,000 kg of fuel during the test. Defuel (Ref. 28-25-00, Servicing) if necessary.

(5) Check that the refuel control panel access door is closed.

(6) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(7) Open the tank access side panel 571 EZ in the landing gear bay (Ref. 28-10-00, Servicing).

B. Test

(1) At the fuel management panel, set the appropriate PUMP switch (tank 5 LH for tank 5-1 transfer; tank 5 RH for tank 5-2 transfer) to "ON". Check that the LOW PRESS caption is illuminated, and then extinguished after 3 s as pump pressure builds up.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(2) Observe the valve through the aperture in the landing gear bay and check, during a 2 min period of fuel transfer, that there is no fuel leakage from the pipes-to-valve and valve-to-tank joints.

(3) Set the PUMP switch to "OFF".

C. Conclusion

(1) Refit the tank access panel.

(2) Refuel the tank (Ref. 12-11-28) and check that there is no fuel leakage from the access panel joint.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

6. Leakage Test - Tank 7 Valve

A. Prepare

R NOTE: Tank 7 valve controls fuel transfer from tank 7 to
R tank 3.

R (1) Make available electrical ground power as detailed
R in 24-41-00.

R (2) Refuel (Ref. 12-11-28) or defuel (Ref. 28-25-00,
R Servicing) tank 7 to achieve a fuel quantity of
R approximately 1,500 kg.

R (3) Ensure that tank 3 has the capacity to receive
R 1,500 kg of fuel during the test.

R (4) Check that the refuel control panel access door is
R closed.

R (5) Ensure that all fuel management panel switches are
R at their normal ground settings (Ref. 28-00-00,
R Servicing). Place a placard at the panel warning
R that the positions of the switches must not be
R altered.

R (6) Open access panel 625 ZT in the wing top surface
R (Ref. 28-10-00, Servicing).

R B. Test

R (1) At the fuel management panel, set tank 7 LH PUMP
R switch to "ON". Check that the LOW PRESS caption
R is illuminated, and then extinguished after 3 s as
R pump pressure builds up.

R WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY
R PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

R (2) Observe the valve through the aperture in the wing
R top surface, and check, during a 3 min period of
R fuel transfer, that there is no fuel leakage from
R the pipes-to-valve and valve-to-tank joints.

R (3) Set the PUMP switch to "OFF".

R C. Conclusion

R (1) Refit the access panel.

R (2) Switch off and disconnect electrical ground power as
R detailed in 24-41-00.

R 7. Leakage Test - Tank 8 Inboard Valve

R A. Prepare

R NOTE: Tank 8 inboard, forward valve controls fuel transfer
R from tank 8 to tank 4. Tank 8 inboard, aft valve
R controls fuel transfer from tank 8 to tank 3.

R (1) Check, by reference to the aircraft attitude indicator
R (Ref. 28-11-00, Description and Operation) that the
R aircraft is positioned in the nominal ground attitude.
R Reposition the aircraft if necessary.

R (2) Make available electrical ground power as detailed in
R 24-41-00.

R (3) Refuel (Ref. 12-11-28) or defuel (Ref. 28-25-00,
R Servicing) tank 8 to achieve a fuel level which is
R the lowest that can be effectively read on the
R magnetic level indicator (Ref. 28-11-00, Description
R and Operation). Check this fuel quantity
R (approximately 1,500 kg) also by reference to the
R fuel quantity indicator on the fuel management
R panel.

R (4) Ensure that the receiving tank (4 or 3) has the
R capacity to receive 1,500 kg of fuel during the
R test. Defuel (Ref. 28-25-00, Servicing) if necessary.

R (5) Check that the refuel control panel access door is
R closed.

R (6) Ensure that all fuel management panel switches are
R at their normal ground settings (Ref. 28-00-00,
R Servicing). Place a placard at the panel warning
R that the positions of the switches must not be
R altered.

R (7) Open the tank access side panel 671 EZ in the
R landing gear bay (Ref. 28-10-00, Servicing).

R B. Test

R (1) At the fuel management panel, set the appropriate
R PUMP switch (tank 8 RH for tank 8-4 transfer; tank
R 8 LH for tank 8-3 transfer) to "ON". Check that the
R associated LOW PRESS caption is illuminated, and
R then extinguished after 3 s as pump pressure builds
R up.

R WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY
R PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

R (2) Observe the valve through the aperture in the landing gear bay and check, during a 3 min period of fuel transfer, that there is no fuel leakage from the pipes-to-valve and valve-to-tank joints.

R (3) Set the PUMP switch to "OFF".

R C. Conclusion

R (1) Refit the tank access panel.

R (2) Refuel the tank (Ref. 12-11-28) and check that there is no fuel leakage from the access panel joint.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

SOLENOID VALVE (LEVEL SENSORS) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four electrically operated solenoid valves control the sense lines between the high level sensors installed in tanks 1 and 4 and the respective transfer control valves. Two solenoid valves are located in each of the left and right side wing root fillets. Each valve has two union connectors, projecting through the tank roof, to which the respective sense line pipes are connected.

The solenoid assembly, i.e., the working parts, can be removed without defuelling the tanks, but if the valve body is to be removed it is necessary to defuel and enter tank 1 or 4, as appropriate.

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2. Solenoid Assembly (Ref. Fig.401)

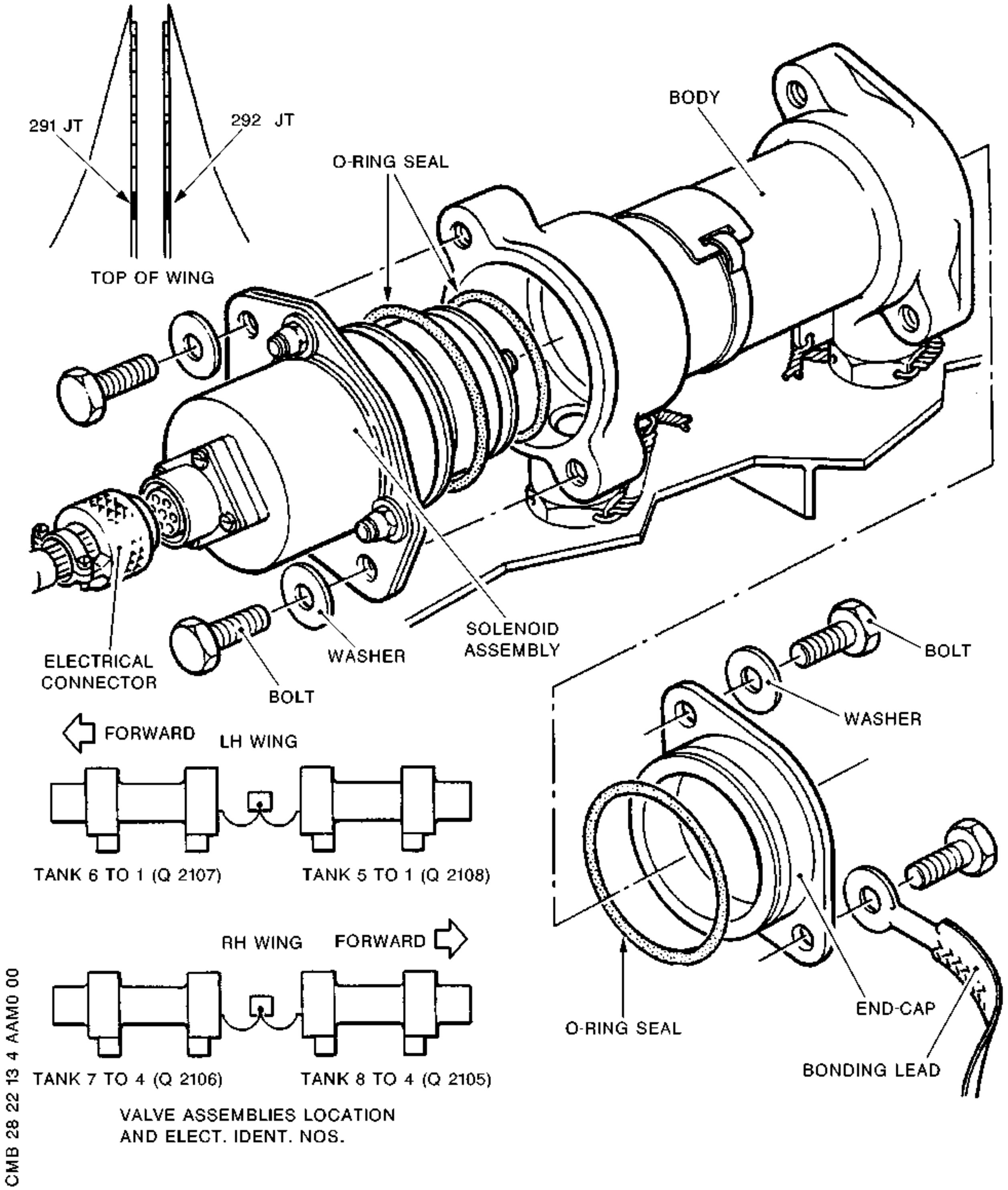
A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 110 to 120 lbf in (1.243 to 1.356 mdaN)	-
Nylon rod, for solenoid removal (length 6 in (152 mm), diameter 0.25 in (6.35 mm), with one end flat and one end convex)	Local manufacture

B. Prepare to Remove Solenoid Assembly

(1) Trip the TANKS 1 & 4 TRIM CONT & IND circuit breaker Q2101 on panel 15-216, map ref. C7, and fit a safety clip.

(2) Trip the appropriate transfer pump supply circuit breaker and fit a safety clip.



Solenoid Assembly - Typical Installation
Figure 401

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 1			
TANK 5-1 PUMP SUP	4-213	Q 905	D 5
TANK 6-1 PUMP SUP	14-215	Q 911	G17
Tank 4			
TANK 7-4 PUMP SUP	14-215	Q 907	E17
TANK 8-4 PUMP SUP	14-216	Q 909	D 1

(3) Remove the appropriate wing fillet access panel (Ref. Fig.401).

C. Remove Solenoid Assembly

(1) Disconnect the electrical connector from the solenoid assembly.

(2) Remove the two bolts and washers securing the solenoid assembly to the body.

(3) Make provision to collect a small amount of spilled fuel, then remove the solenoid assembly from the body. Remove and discard the O-ring seals.

(4) If difficulty is experienced in removing the solenoid assembly, proceed as follows:

(a) Remove the two bolts and bonding lead from the end-cap. Remove the end-cap and discard the O-ring seal.

CAUTION: TO AVOID DAMAGE TO THE INTERNAL VALVE ASSEMBLY, ENSURE THAT THE FLAT END OF THE NYLON ROD IS IN CONTACT WITH THE INTERNAL FLAT FACE OF THE SOLENOID HOUSING.

(b) Using the nylon rod, carefully push the solenoid assembly out of the body.

(5) Fit suitable blanks to the valve body.

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D. Install Solenoid Assembly

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) If the end-cap has been removed, proceed as follows:

(a) Fit a new O-ring seal to the end-cap.

(b) Remove the blank and fit the end-cap to the body with the bolts, washers and bonding lead.

(c) Torque-tighten the bolts to between 110 and 120 lbf in (1.243 to 1.356 mdaN).

(b) Check the bonding in accordance with 20-27-11.

(3) Fit new O-ring seals to the solenoid assembly.

CAUTION: SEE FIGURES 402 AND 403 FOR CORRECT ORIENTATION OF THE SOLENOID ASSEMBLY. ROTATION OF SOLENOID HOUSING AND COVER ASSEMBLY THROUGH 180° CAUSES FOULING ON FILLET PANEL.

(4) Remove the blank and fit the solenoid assembly to the body with the bolts and washers. Torque-tighten the bolts to between 110 and 120 lbf in (1.243 to 1.356 mdaN).

(5) Connect the electrical connector to the solenoid assembly, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Reset the circuit breakers tripped before removal.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Carry out a Functional Test (Ref. Adjustment/Test).

(4) During the test, check that fuel does not leak from the solenoid valve.

(5) Refit the wing fillet access panel.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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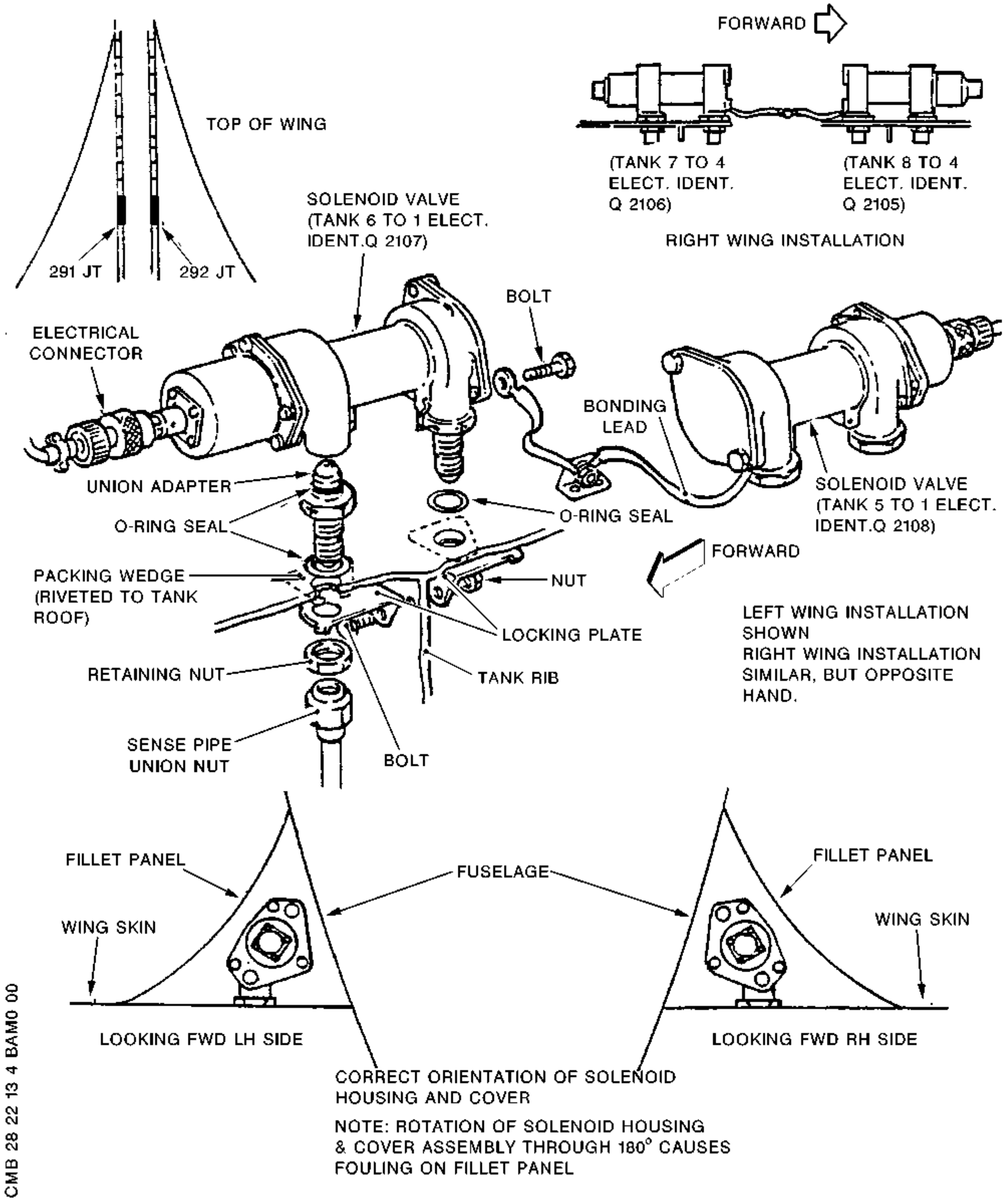

Solenoid Valve - Installation
Figure 402

**ON A/C 001-004,

3. Solenoid Valve (Ref. Fig.402)

**ON A/C 005-007,

3. Solenoid Valve (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Locking wire, 0.028 in (0.7 mm) dia. stainless steel	-
Circuit breaker safety clip	-
Torque spanner, 110 to 120 lbf in (1.243 to 1.356 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-

B. Prepare to Remove Valve

(1) Defuel the appropriate tank (Ref. 28-25-00, Servicing).

(2) Remove the appropriate tank access panel, 523 AB or 623 AB, and prepare the tanks for entry (Ref. 28-10-00, Servicing).

(3) Trip the TANKS 1 & 4 AFT TRIM CONT & IND circuit breaker Q2101 on panel 15-216, map ref. C7, and fit a safety clip.

(4) Trip the appropriate transfer pump supply circuit breaker and fit a safety clip.

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 1			
TANK 5-1 PUMP SUP	4-213	Q 905	D 5
TANK 6-1 PUMP SUP	14-215	Q 911	G17
Tank 4			
TANK 7-4 PUMP SUP	14-215	Q 907	E17
TANK 8-4 PUMP SUP	14-216	Q 909	D 1

(5) Remove the appropriate access panel in the wing fillet.

C. Remove Solenoid Valve

(1) Disconnect the bonding lead at its attachment point on the valve.

(2) Disconnect the electrical connector from the valve.

(3) From inside the tank, disconnect the sense pipe union nuts from the two union adapters on the valve. Fit suitable blanks to the open ends of the sense pipe.

(4) Bend back the tabs of the locking plates which lock the two solenoid retaining nuts and remove the nuts. Remove the bolt and nut securing the locking plates to the tank rib and discard the locking plates.

(5) From outside the tank, remove the solenoid valve from the wing fillet and discard the O-ring seal at the base of the hexagonal flange of each adapter.

(6) If a new solenoid valve is to be fitted, unlock and remove the two union adapters from the valve and discard the O-ring seal at the valve insert end of each union adapter. Retain the adapters to fit to the new valve.

(7) Fit suitable blanks to the two apertures in the top of the tank.

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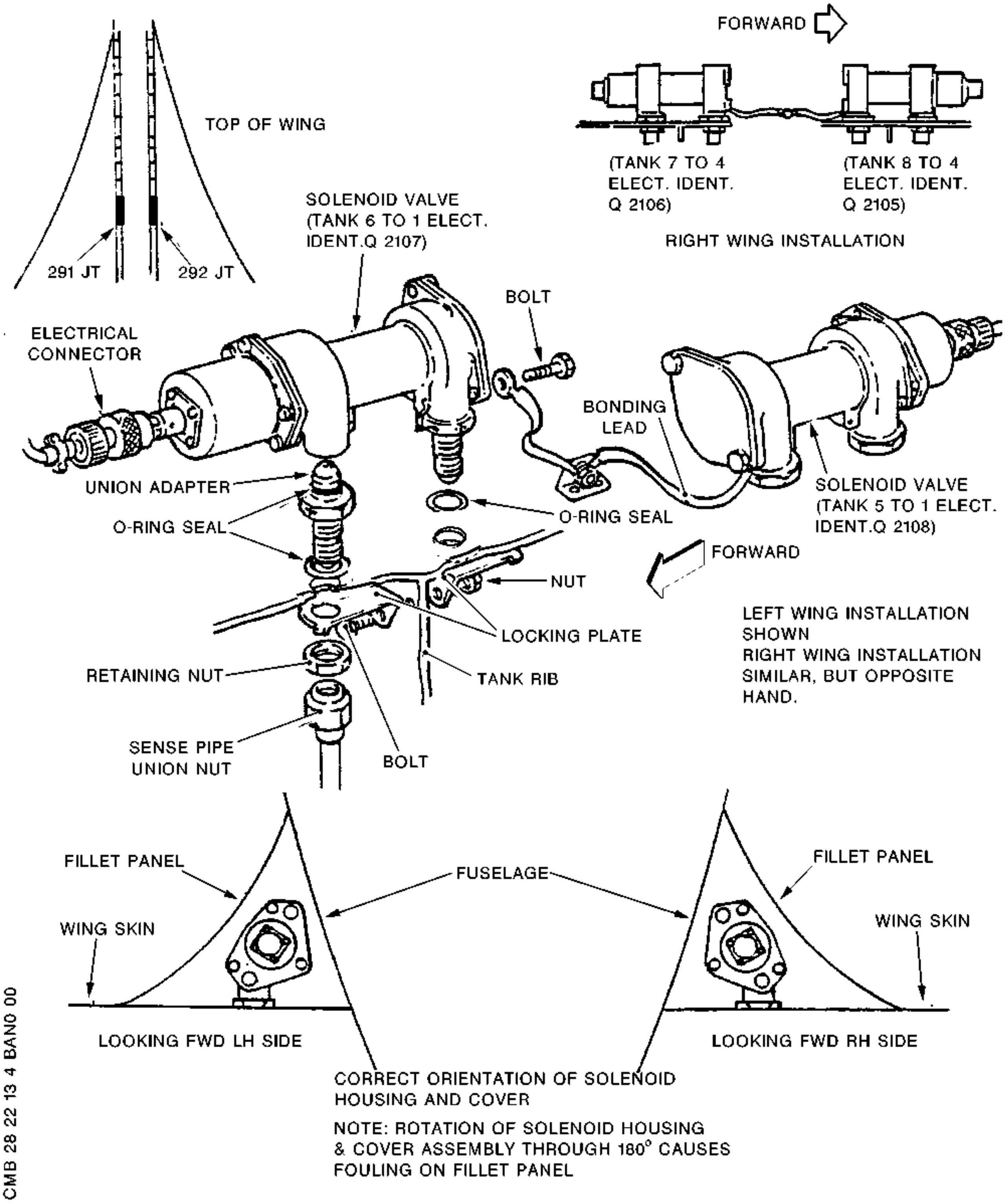

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Solenoid Valve - Installation
Figure 403

D. Install Solenoid Valve

(1) If a new solenoid valve is to be fitted, proceed as follows:

(a) Fit the union adapters removed from the old valve to the new valve, together with two new O-ring seals, which have been lubricated in accordance with 20-23-11, to each union adapter.

(b) Torque-tighten each union adapter to between 107 and 117 lbf in (1.209 and 1.322 mdaN) and wire-lock each adapter to the valve body in accordance with 20-21-13.

(2) Ensure that the safety precautions taken before removal have not been cancelled.

(3) Remove the blanks from the apertures at the top of the tank.

CAUTION: THE SOLENOID VALVES ARE 'HANDED'. ENSURE THAT THE CORRECT COMPONENT FOR THE PARTICULAR INSTALLATION IS BEING INSTALLED. SEE FIGURES 402 AND 403 FOR CORRECT ORIENTATION OF THE SOLENOID VALVE.

(4) Position the solenoid in the wing fillet with its two union adapters protruding through the apertures.

(5) From inside the tank, fit the two locking plates and secure them to the tank rib with a nut and bolt. Torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(6) Fit the two solenoid-retaining nuts. Torque-tighten each nut to between 107 and 117 lbf in (1.209 and 1.322 mdaN) and bend over the tabs of the locking plates to lock each nut.

(7) Connect the sense pipes to the union adapters. Torque-tighten the sense pipe union nuts to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(8) From outside the tank, reconnect the bonding lead to the solenoid valve. Torque-tighten the bolt to between 110 and 120 lbf in (1.243 and 1.356 mdaN). Check the bonding in accordance with 20-27-11.

(9) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

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E. Conclusion

(1) Reset the circuit breakers tripped before removal.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Carry out a Leakage Test (Ref. Adjustment/Test).

(4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(5) Refit the tank access panel, 523 AB or 623 AB.

(6) Carry out a Functional Test (Ref. Adjustment/Test).

(7) Refit the wing fillet access panel.

(8) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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SOLENOID VALVE (LEVEL SENSORS) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

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1. General

Four solenoid valves, mounted in the wing fillets above tanks 1 and 4 (two valves to each tank), are used to select the fuel control level in the main collector tanks 1 and 4.

The valves are open and de-energized when their NORM/AFT TRIM control switch, at the fuel management panel (5-214), is set to NORM. When the control switch is set to AFT TRIM, the solenoid valves are energized and inhibit fuel level sensing of the high level transfer-control-valve sensors.

A magnetic indicator on panel 5-214, associated with the control switch, displays NORM, diagonal stripes or AFT, depending on control switch selection. The indicator does not confirm the solenoid valves operation, but only that an electrical supply via the control switch is available.

For the valve locations, refer to Removal/Installation.

The following procedures comprise a Functional Test which entails transferring fuel, and a Leak Test which necessitates draining and entering the appropriate tank. The Leak Test is only necessary when a valve body has been changed. An Operational and a System Test are not considered necessary in this application.

2. Functional Test

A. Prepare

CAUTION: ENSURE THAT EXISTING FUEL LOAD DISTRIBUTION WILL PERMIT THE TRANSFER OF FUEL WITHOUT AIRCRAFT OVERBALANCE OCCURRING.

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00), that the aircraft is laterally level (0 deg roll) and longitudinally between level and 1 3/4 deg nose-up (between 0 and +1 3/4 deg pitch). Reposition the aircraft if necessary.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Ensure that the collector tank, associated with the valve under test, contains not more than 1,500 kg of fuel. Transfer fuel or defuel (Ref. 28-25-00, Servicing) if required.

(5) Ensure that the associated transfer tank (Ref. Table 501) contains not less than 3,000 kg of fuel.

(6) Set the LIGHTS CTR switch on panel 6-214 to "TEST". Check that any captions on the fuel management panel not previously illuminated, are illuminated. Release the test switch and check that the captions are extinguished.

NOTE: Some captions, e.g., tanks 1 and 4 U/FULL, will remain illuminated.

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B. Test

(1) Set the control switch to "AFT TRIM". Check that tanks 1 and 4 U/FULL captions are extinguished and the magnetic indicator display changes to AFT.

(2) Note the time and the collector tank and transfer tank fuel quantities.

(3) Set the associated transfer pump switch (Ref. Table 501) to "ON". Check that the LOW PRESS caption is illuminated and then extinguished within 3 s.

SOLENOID VALVE (Wing fillet)	ASSOCIATED TANK/TRANSFER PUMP SWITCH	MINIMUM FLOW RATE (kg/min)
No.1 tank, fwd. (Elect. ref. Q2107)	Tank 6, LH	249
No.1 tank, rear (Elect. ref. Q2108)	Tank 5, LH	320
No.4 tank, rear (Elect. ref. Q2106)	Tank 7, RH	267
No.4 tank, fwd. (Elect. ref. Q2105)	Tank 8, RH	311

Solenoid Valve with Associated Pump Switch and Flow Rate
Table 501

(4) Check by reference to the FQIs, that fuel is transferring to the appropriate collector tank.

(5) When fuel transfer stops, note the time and the collector tank and transfer tank quantities. Check that the transfer flow rate and fuel control level agree with Tables 501 and 502.

CONTROL SWITCH POSITION	TANK FUEL CONTROL LEVELS (FQI)	CORRECTION FACTOR (For each 10 min pitch above 0 deg)
AFT TRIM	1,700 to 2,000 kg	Add 10 kg
NORM	3,750 to 4,000 kg	Add 5 kg

NOTE: A correction must be applied to the control level fuel quantity if the aircraft is not level (0 deg pitch and 0 deg roll).

Tanks 1 and 4 Fuel Control Levels
Table 502

(6) Leave the pump switched on, and check that no more fuel is transferred over a period of 5 min.

(7) With the pump still on, set the control switch to "NORM". Check that:

(a) the collector tank U/FULL caption is illuminated,

(b) the magnetic indicator display changes to NORM,

and

(c) fuel is transferring into the collector tank.

(8) When the fuel quantity in the collector tank reaches approximately 3,390 kg, check that the associated U/FULL caption is extinguished.

(9) Check that transfer into the collector tank ceases when the fuel control level agrees with Table 502.

(10) Leave the pump switched on, and check that no more fuel is transferred over a period of 5 min.

(11) Set the pump switch to "OFF".

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C. Conclusion

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Before Modification 0425	
Bung, pipe outlet, tanks 6-1, 5-1, 8-4 and 7-4	E925118002
After Modification 0425	
Blank, pipe outlet, tanks 6-1, 5-1, 8-4 and 7-4	E925119000
Nylon cord	-
Suitable fuel spillage container	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Attach a placard to the management panel, indicating that the fuel system is being worked on and fuel system controls must not be operated.

(4) Remove the appropriate wing fillet access panel (Ref. Removal/Installation).

(5) Defuel the appropriate collector tank 1 or 4 (Ref. 28-25-00, Servicing). Ensure that the associated transfer tank (Ref. Table 501) contains at least 1,000 kg of fuel.

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(6) Remove the appropriate tank access panel, 523 AB (tank 1) or 623 AB (tank 4), and prepare the tanks for entry (Ref. 28-10-00, Servicing).

(7) Fit a blank to the valve's associated transfer pipe outlet, in the collector tank (Ref. Table 501).

(8) Gain access to the associated high and low level sensors (Ref. 28-22-11, Removal/Installation).

(9) Using nylon cord, secure in the fully up position the floats of the associated high level and low level sensors (Ref. Table 503).

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SOLENOID VALVE (Wing fillet)	LOW LEVEL SENSOR (Tank floor mounting)	HIGH LEVEL SENSOR (Tank roof mounting)
No.1 tank, fwd. (Elect. ref. Q2107)	Tank 1, inbd.	Tank 1, inbd.
No.1 tank, rear (Elect. ref. Q2108)	Tank 1, outbd.	Tank 1, outbd.
No.4 tank, rear (Elect. ref. Q2106)	Tank 4, outbd.	Tank 4, outbd.
No.4 tank, fwd. (Elect. ref. Q2105)	Tank 4, inbd.	Tank 4, inbd.

Solenoid Valves and Associated Sensors Location
Table 503

C. Test

(1) Position a suitable container to collect spilled fuel from the high level sensor (Ref. Table 503).

(2) Set the associated transfer pump switch (Ref. Table 501) to "ON". Check that its LOW PRESS caption is illuminated and then extinguished within 3 s.

(3) Slacken the cord securing the high level sensor float and allow fuel to spill from the high level sensor into the container for 30 s. Then secure the high level sensor (Ref. Table 503) float in the fully up position with the nylon cord.

NOTE: This will bleed air from within the sensing pipes.

(4) With the pump still on, check, over a period of 5 min, that there are no fuel leaks from the sense pipe connections and the solenoid valve.

(5) Set the transfer pump switch to "OFF".

D. Conclusion

(1) Remove the nylon cord from the lower and high level sensor floats. Ensure that the floats have full and free movement.

(2) Remove the blank from the transfer pipe outlet.

(3) Remove the container from the tank.

(4) Ensure that all equipment has been removed from the tank.

R (5) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (6) Ensure that the tank access panel mating surfaces are clean, free from damage and corrosion and lightly coated with Grease Aeroshell 16, DTD 900/4841.

R (7) Refit the access panels:

(a) For tank 1: 523 CT, 291 JT and 523 AB.

(b) For tank 4: 623 CT, 292 JT and 623 AB.

R (8) Remove the placard from the fuel management panel.

R (9) Refuel the tank (Ref. 12-11-28). Check that there are no fuel leaks from the tank access panels.

R (10) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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PUMP UNITS (TANKS 5, 6, 7 AND 8) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pump units are installed in each of tanks 5, 6, 7 and 8. Each unit is secured to the floor of the tank and comprises a pump element fitted into an isolation canister, which permits the element to be removed without draining fuel from the tank. The tank must be drained if a canister is to be removed.

All the pump elements are identical but the canisters in tanks 5 and 7 differ in external shape from those in tanks 6 and 8. A non-return valve is fitted in the canister outlet of tank 6 rear pump and tank 8 forward pump only.

This topic comprises removal and installation procedures applicable to the pump element, the isolation canister, the canister flap relief and outlet non-return valves.

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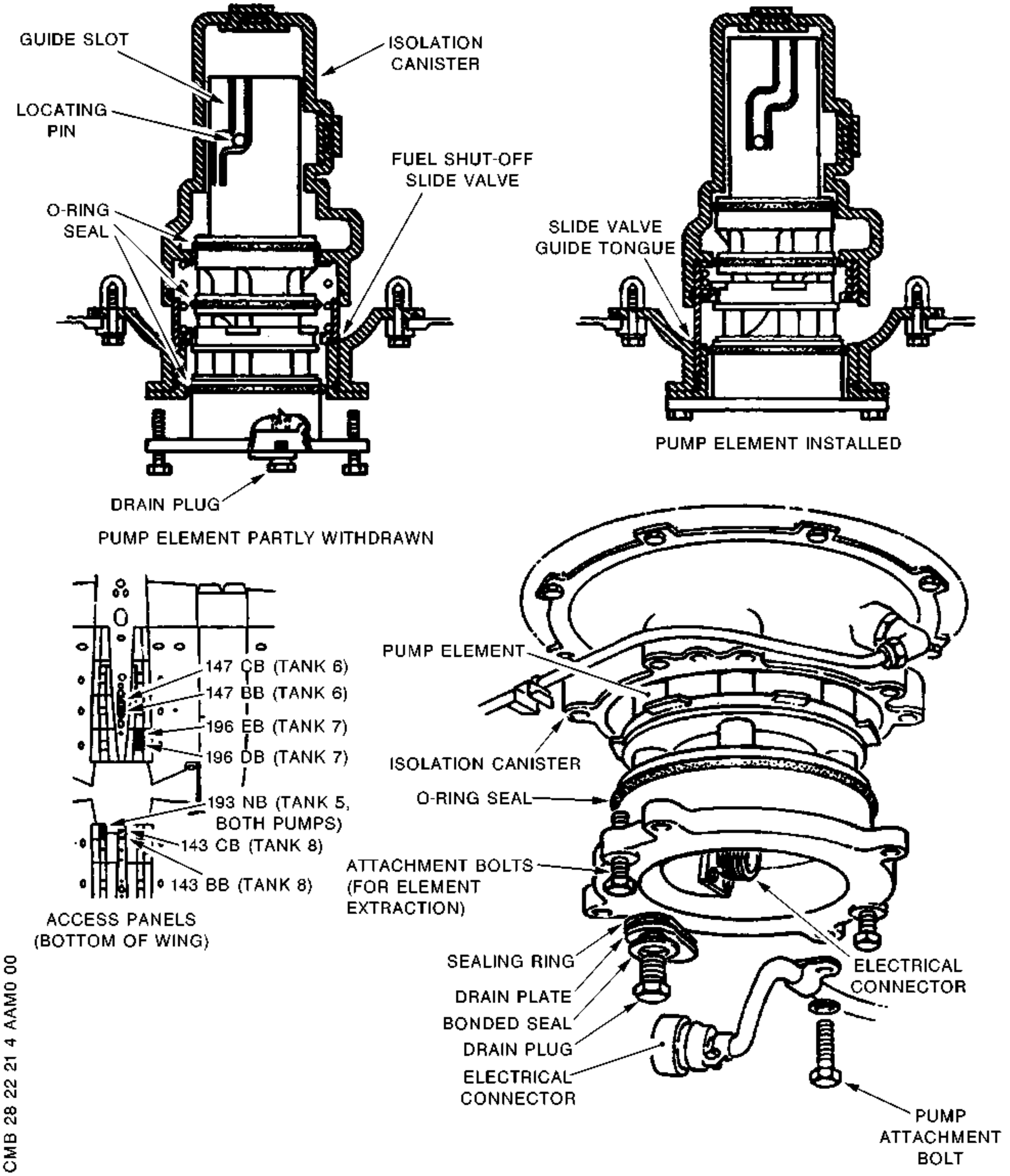
2. Pump Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 95 to 105 lbf in (1.073 to 1.186 mdaN)	-
Electrical bonding tester	-
Container, for fuel drainage	-
Approved marking agent	-

B. Prepare to Remove Pump Element

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.



Pump Element - Installation (Typical)
Figure 401

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(2) Electrically isolate the pump to be removed, by tripping the associated circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5-1 PUMP SUP (forward pump)	4-213	Q 905	D 5
TANK 5-2 PUMP SUP (rear pump)	13-215	Q 906	E19
TANK 6-1 PUMP SUP (forward panel)	14-215	Q 911	G17
TANK 6-2 PUMP SUP (rear pump)	13-216	Q 912	F 1
TANK 7-4 PUMP SUP (forward pump)	14-215	Q 907	E17
TANK 7-3 PUMP SUP (rear pump)	4-213	Q 908	C 8
TANK 8-4 PUMP SUP (forward pump)	14-216	Q 909	D 1
TANK 8-3 PUMP SUP (rear pump)	13-215	Q 910	G19

(3) Gain access to the pump by removing the appropriate access panel in the wing or fuselage lower surface (Ref. Fig.401).

(4) Place a suitable container in position to collect any fuel that may drain from the pump during removal.

NOTE: Up to 4 gal (Imp.) (18.2 l) of fuel may drain from the transfer pipes when the element of the forward pump in tank 6 or 7 is removed. Fuel drainage from the other pumps should not exceed 1 gal (Imp.) (4.5 l).

C. Remove Pump Element

(1) Disconnect the electrical connector from the pump unit.

(2) Using an approved marking agent, draw a correlation mark on the electrical connector mounting boss, and then continue the correlation mark on to a suitable point on the canister.

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(3) Cut and remove the locking wire securing the pump element drain plug. Release, but do not unscrew, the drain plug to facilitate its subsequent removal.

(4) Remove the four bolts and washers securing the pump element to the isolation canister. Note the position of the electrical cable clip for subsequent installation.

(5) Fit two 1/4-28 UNF bolts into the extractor holes in the element flange and screw them in evenly to withdraw the element as far as the guide slot will permit.

NOTE: At this stage, the pump element is withdrawn approximately 1 in (25 mm) and the slide valve should be seated, closing the fuel ports to the tank.

(6) Unscrew the drain plug sufficiently to permit the drain plate to be swung clear of the drain hole. Move the plate and allow fuel to drain from the element into the container.

(7) Remove the drain plug, bonded seal, drain plate and sealing ring. Discard the bonded seal and sealing ring.

(8) Turn the pump element counter-clockwise until it is checked by the guide slot, then withdraw it from the isolation canister. Remove the bolts from the extractor holes.

NOTE: Limited fuel leakage from the canister valves is permitted (Ref. para.D.).

(9) Remove and discard the three O-ring seals from the pump element body.

(10) Loosely refit the drain plate and drain plug and fit suitable blanks to the ports of the isolation canister and pump element.

D. Prepare to Install Pump Element

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the isolation canister and pump element.

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(3) If the tank contains fuel, check the total fuel leakage from all the isolation canister valves. If the following leakage rate is exceeded, renew the faulty valve (Ref. paras.4 and 5.).

Canister not fitted with outlet NRV:

0.1 gal/h (Imp.) (0.45 l/h)

Canister fitted with outlet NRV (tank 6 rear pump, tank 8 forward pump):

1.1 gal/h (Imp.) (5.0 l/h)

(4) Fit a new, dry, sealing ring to the drain plate. Lubricate the exposed surfaces of the sealing ring in accordance with 20-23-11, and then fit the drain plate to the pump element and secure it with a new bonded seal and the drain plug.

(5) Fit three new O-ring seals to the pump element body.

NOTE: The O-ring seals must be fitted dry, and the exposed surfaces lubricated in accordance with 20-23-11.

(6) Prior to installing a new pump element, draw a correlation mark on the electrical connector mounting boss, using an approved marking agent.

(7) If the tank is empty, check that the fuel shut-off slide valve is fully extended and correctly seated.

E. Install Pump Element

NOTE: The torque-tightening values of the pump element attachment bolts require the addition of the frictional resistance.

(1) Using a torque spanner, measure and record the torque load required to screw each pump element attachment bolt into its mating thread. Check that this torque load (i.e., frictional resistance) is within the limits of 3.5 to 30 lbf in (0.040 to 0.339 mdaN).

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CAUTION: THE SLIDE VALVE MUST NOT BE OPERATED WHEN DRY. SPRAY FUEL BETWEEN THE SLIDE VALVE AND CANISTER BEFORE INSERTING THE PUMP ELEMENT.

(2) Insert the pump element into the isolation canister, aligning the correlation marks and engaging the guide pin in the pump element guide slot.

(3) Carefully slide the pump element in until the guide pin abuts the stop of the guide slot. The pump element will then be approximately 1 in (25 mm) from the fully inserted position.

CAUTION: THE FOLLOWING OPERATION WILL LIFT THE SLIDE VALVE AND OPEN THE FUEL PORTS. DO NOT FORCE THE PUMP ELEMENT OR DAMAGE TO THE SLIDE VALVE MAY RESULT. DO NOT USE THE ATTACHMENT BOLTS TO ASSIST THE PUMP ELEMENT INTO POSITION.

(4) Turn the pump element clockwise and then, using hand pressure only, push it fully in, aligning the attachment bolt holes.

(5) Holding the pump element in position, secure it with the four bolts and washers, locating the cable clip on the appropriate bolt in the position noted during removal.

(6) Progressively tighten the bolts evenly in a diametrically opposite sequence and then torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN), plus the frictional resistance (Ref. para.(1)).

(7) Torque-tighten the drain plug to between 95 and 105 lbf in (1.073 and 1.186 mdaN) and wirelock the plug in accordance with 20-21-13.

(8) Connect the electrical connector to the pump element, ensuring that the mating surfaces are clean and undamaged.

(9) Using a bonding tester, check that the electrical resistance between the pump element and the isolation canister is not greater than 0.01 ohm.

F. Conclusion

(1) Remove the safety clip and reset the circuit breaker tripped prior to removal.

(2) Remove the warning placard from the fuel management panel.

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(3) Carry out a Functional Test of the pump element (Ref. Adjustment/Test).

(4) Refit the access panel and torque-tighten the securing bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

3. Isolation Canister (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Viton rubber, (Ref. 20-30-00, No.200), for tank 6 or 8 filter collar/canister sealing	-
Electrical bonding tester	-
Suitable suction equipment to collect spilled fuel	-
After SB 28-018 For A/C 001-005,	
Sealant, PR 1720R (Ref. 20-30-00, No.390) and PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Canister

(1) Drain the tank from which the canister is to be removed (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. para.2.).

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(3) Except tank 8: Open the appropriate tank access panel (Ref. Fig. 402) in the wing or fuselage lower surface to gain access to the canister from within the tank.

(4) Tank 8: Gain access to the canisters, as follows:

(a) Remove the panel in the bottom of the fuselage.

(b) Remove panel 143 AZ in the bulkhead frame aft of that location inside the tank.

(c) Remove the probe (Ref. 28-44-31) immediately aft of the bulkhead frame.

C. Remove Canister

<u>WARNING</u>: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Remove the pressure switch pipe from the canister, as follows:

(a) Tank 6 or 8

a1) From inside the tank, disconnect the pressure switch pipe from the canister restrictor union and from the union at the other end of the pipe.

a2) Disconnect the pipe clip from the bracket and note the attachment location of the bonding lead for subsequent installation.

a3) Remove the pipe.

(b) Tank 5 or 7

b1) From outside the tank, disconnect the pressure switch pipe from the canister restrictor union and from the union at the pressure switch.

b2) In tank 5, disconnect the pipe clip from the bracket.

b3) Remove the pipe.

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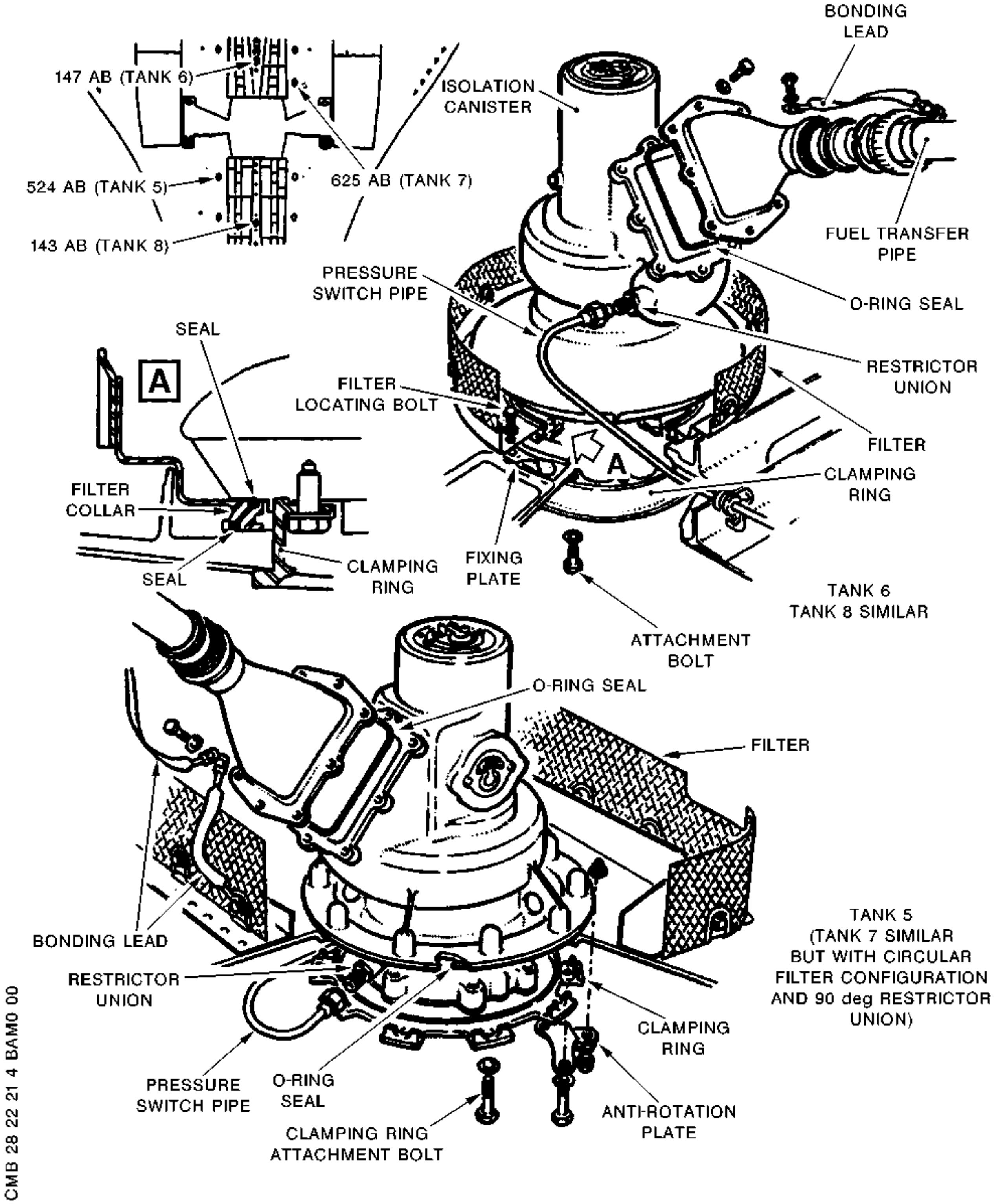

Isolation Canister - Installation
Figure 402

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(2) From inside the tank, remove the bolts and washers connecting the pump outlet pipe flange to the canister. Note the position of the bonding bolt and, where applicable, the attachment location of the bonding leads. If necessary, slacken the adjoining pipe connections to allow sufficient clearance for removal of the canister.

NOTE: In tank 6 rear pump and tank 8 forward pump, the non-return valve will trap any residual fuel in the transfer pipeline. These couplings must therefore be disconnected slowly and spilled fuel must be collected immediately, preferably by means of suitable suction equipment.

(3) From outside the tank, disconnect the canister as follows:

(a) Tank 5: Remove the nut and washer from the anti-rotation plate attachment stud.

(b) Tank 7: Remove the bolt and nut securing the anti-rotation plate to the structure.

(c) Tank 5 or 7: Remove the ten bolts and washers securing the clamping ring to the canister. Note the position of the bonding bolt for subsequent installation.

(d) Tank 6 or 8: Remove the eight bolts and washers securing the clamping ring to the canister. Note the position of the bonding bolt for subsequent installation.

(e) Remove the clamping ring together with the anti-rotation plate (where applicable).

(4) From inside the tank, remove the canister.

(5) Tank 5 or 7: Remove and discard the O-ring seal from the annular flange face of the canister.

(6) Tank 6 or 8: Remove the pump filter locating bolt and washer. Remove the filter and remove and discard the upper and lower seals from the filter collar.

(7) Fit suitable blanks to all exposed ports and apertures.

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D. Prepare to Install Canister

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the ports and apertures.

(3) Ensure that the joint surfaces of the canister, the mounting aperture in the tank, the pump outlet attachment flange, the filter collar (tank 6 or 8) and the anti-rotation plate (tank 5 or 7), are clean and free from corrosion.

(4) If a new canister is to be fitted, remove the pressure switch pipe restrictor union from the original canister and fit it, together with a new O-ring seal lubricated in accordance with 20-23-11, to the replacement canister. Torque-tighten a straight restrictor union to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(5) Tank 7, either canister: Loosely fit the 90 deg restrictor union and O-ring seal as detailed in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'.

(6) Tank 6 or 8: Renew the upper and lower seals of the filter collar, using lengths of specially profiled Viton rubber, joint the scarfed ends by bonding with Viton sealant PR 1720, in accordance with 20-22-21.

E. Install Canister

Before SB 28-018

(1) Tank 6 or 8: Insert the new seals, lubricated in accordance with 20-23-11, in the upper and lower grooves of the filter collar.

After SB 28-018 For A/C 001-005,

(1) Tank 6 or 8: Insert the new, dry, seals in the upper and lower grooves of the filter collar and apply Viton sealant to the mating surfaces of the tank, the filter collar and the canister (Ref. Fig.402), using either of the following sealants:

(a) PR 1720R (prefabricated tape): re-activate the Viton, using cyclohexanone, during application.

(b) PR 1720SM (semi-paste/fluid), applied by brush or spatula in accordance with 20-22-21, where tape cannot be applied.

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(2) Tank 6 or 8: Inside the tank, install the pump filter and secure it to the fixing plate with the filter locating bolt and washer.

Before SB 28-018

(3) Tank 5 or 7: Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the annular groove in the canister flange face.

After SB 28-018 For A/C 001-005,

(3) Tank 5 or 7: Fit a new, dry, O-ring seal to the annular groove in the canister flange face and apply Viton sealant to the mating surfaces of the tank and the canister, using the sealants as detailed in paragraph (1).

(4) Inside the tank, position the canister on its mounting in the bottom of the tank. Outside the tank, place the clamping ring and anti-rotation plate (tank 5 or 7) in position. Fit the clamping ring attachment bolts and washers, ensuring that the bonding bolt is correctly positioned. Do not tighten the bolts at this stage.

NOTE: Tank 6 or 8: A lug on the clamping ring and unequally-spaced bolt holes ensure correct alignment of the canister.

Tank 5 or 7: The canister outlet must be aligned with the fuel transfer pipe before the anti-rotation plate is positioned.

(5) Tank 7, either canister: Complete the installation of the 90 deg restrictor union and O-ring seal as detailed in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'. Torque-tighten the restrictor union nut to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(6) Connect one end of the pressure switch pipe to the restrictor union and the other end to the tank or pressure switch union, as applicable. Torque-tighten the pipe union nuts to between 40 and 45 lbf in (0.452 and 0.734 mdaN). If applicable, secure the pipe clip and bonding lead in the position noted during removal.

(7) Tank 5: Secure the anti-rotation plate to the attachment stud with the nut and washer.

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(8) Tank 7: Secure the anti-rotation plate to the structure with the bolt and nut.

(9) Ensure that the canister is positioned concentrically on its mounting and then tighten the attachment bolts, evenly, in a diametrically opposite sequence. Finally, torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(10) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the pump outlet pipe flange. Secure the flange to the canister with the bolts and washers, ensuring that the bonding bolts and, where applicable, the bonding leads, are correctly positioned. Tighten the bolts, evenly, in a diametrically opposite sequence. Finally, torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

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(11) Refit the disturbed Gamah couplings on the fuel transfer pipe as detailed in 20-23-21.

(12) Check that the electrical bonding between the transfer pipe, isolation canister, filter collar and tank structure is in accordance with 20-27-11.

(13) Manually operate the canister flap relief valves and check that they move freely and close correctly when released.

F. Conclusion

(1) Carry out a Leakage Test of the canister and transfer pipe joints (Ref. Adjustment/Test).

(2) Tank 8: Refit the probe (Ref. 28-44-31).

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Tank 8: Refit the bulkhead frame access panel 143 AZ. Torque-tighten the nuts to between 40 and 49 lbf in (0.452 and 0.554 mdaN).

R (5) Refit the tank access panel (Ref. Fig.402) and torque-tighten the bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

R (6) Using a safety ohmmeter, check that the electrical resistance between the panel and the associated structure does not exceed 10 milliohm.

R (7) Refuel the tank (Ref. 12-11-28). Check the tank access panel and, if applicable, the probe access panel for freedom from leakage.

R (8) Install the pump element (Ref. paras.2.D. and 2.E.).

4. Flap Relief Valve (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
AF hexagonal key, 9/64 in (3.5 mm)	-
Right-angled torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	Plessey 558-4-03288
Torque screwdriver, 3 to 5 lbf in (0.034 to 0.056 mdaN)	-
Torque screwdriver, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-

B. Prepare to Remove Relief Valve

(1) Defuel the appropriate tank (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. para.2.).

C. Remove Relief Valve

(1) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers securing the flap valve mounting adapter to the canister and withdraw the mounting adapter, complete with flap valve.

(2) Remove the screws and washers securing the flap valve to the mounting and remove the valve. Remove and discard the sealing ring.

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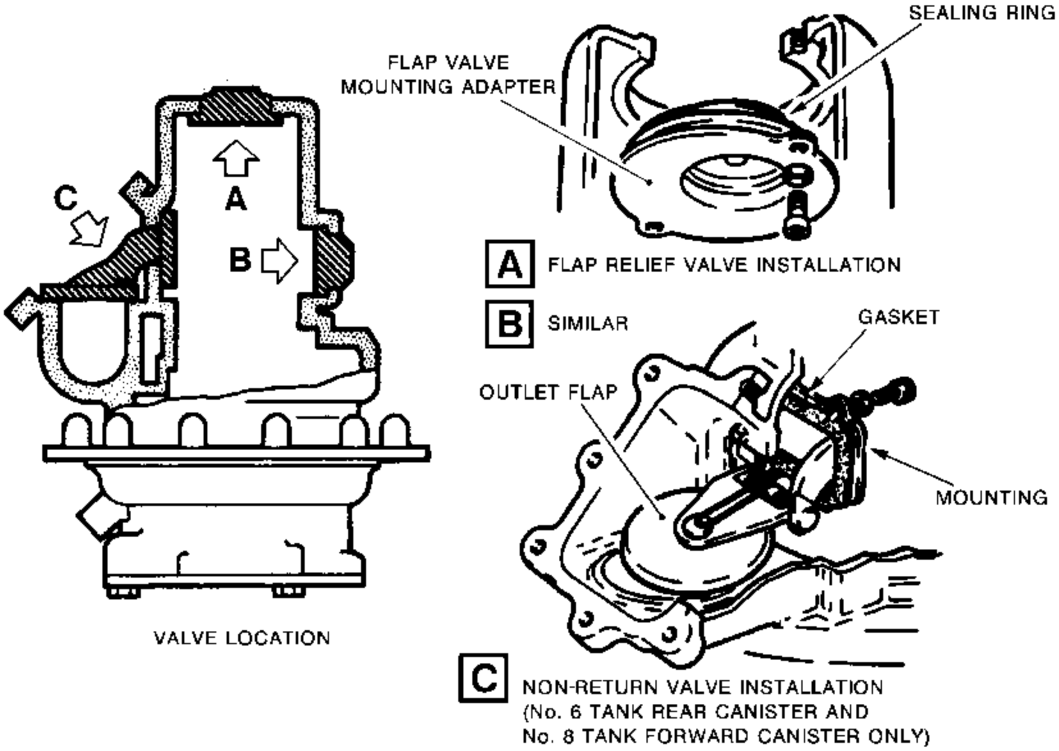

Flap Relief and Outlet Non-return Valves - Installation
Figure 403

D. Install Relief Valve

<u>CAUTION</u>: WHEN A SIDE-MOUNTED VALVE IS REFITTED (DETAIL B), ENSURE THAT THE VALVE IS POSITIONED WITH THE HINGE UPPERMOST. TIGHTEN ALL THE SCREWS EVENLY. UNEVEN TIGHTENING CAN DISTORT THE VALVE MOUNTING PLATE AND CAUSE MALFUNCTIONING.

(1) Fit a new flap valve to the mounting adapter. Torque-tighten the securing screws to between 3 and 5 lbf in (0.034 and 0.056 mdaN).

(2) Fit a new, dry, sealing ring in the groove around the mounting adapter, then lubricate the exposed surface in accordance with 20-23-11.

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(3) Locate the valve assembly in its bore from within the canister, aligning the attachment holes. Fit the securing washers and screws. Torque-tighten the screws to between 9 and 11 lbf in (0.102 and 0.124 mdaN), using the right-angled torque spanner if the valve is located in the side wall, or the torque screwdriver, with a hexagonal key insert, if the valve is in the canister crown.

(4) Manually operate the flap valve and check that it opens freely and closes correctly when released.

(5) Refuel the tank (Ref. 12-11-28).

(6) Check the flap valve for leakage of fuel. The total fuel leakage from all the isolation canister valves must not exceed the following rate:

Canister not fitted with outlet NRV:

0.1 gal/h (Imp.) (0.45 l/h)

Canister fitted with outlet NRV (tank 6 rear pump, tank 8 forward pump):

1.1 gal/h (Imp.) (5.0 l/h)

E. Conclusion

(1) Install the pump element (Ref. para.2.).

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5. Non-return Valve (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Right-angled torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	Plessey 558-4-03288
AF hexagonal key, 9/64 in (3.5 mm)	-
Locking compound, Loctite Grade A, (Ref.20-30-00, No.109)	-
Sealant, PR 1005L (Ref. 20-30-00, No.372)	-
Methylethylketone, for removing sealant (Ref. 20-30-00, No.470)	-
Container, 5 gal (Imp.) (22.7 l), for drained fuel	-

B. Prepare to Remove Non-return Valve

(1) Remove the pump element (Ref. para.2.).

C. Remove Non-return Valve

(1) Position a clean container to collect residual fuel that will drain from the fuel transfer pipe during the next operation.

(2) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers and carefully withdraw the non-return valve assembly, complete with gasket, from the outlet bore.

NOTE: When the screws are being removed the pressure applied by the spring will cause the valve mounting to tilt forward the centre of the canister bore.

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D. Install Non-return Valve

WARNING: METHYLETHYLKETONE IS BOTH HIGHLY FLAMMABLE AND TOXIC. IT IS ESSENTIAL THAT THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS ARE TAKEN WHEN USING THIS SOLVENT.

(1) Using methylethylketone, remove the old gasket and clean and degrease the face of the non-return valve mounting plate.

(2) Lightly coat the gasket mating face, of the mounting plate only, with sealant PR 1005L, ensuring that the sealant is kept clear of the securing holes. Allow the sealant to dry until it is firm to touch (approximately 15 min).

NOTE: Operations (3) to (6) must be effected within 20 min of applying the sealant.

(3) Fit the gasket to the mounting plate, ensuring the holes are correctly aligned.

(4) Ensure that the gasket mating face of the canister is clean and then position the valve assembly in the canister with the valve-flap spring uppermost. Guide the valve flap into the outlet duct and ensure that the spigot of the mounting plate has entered the duct.

(5) Secure the valve assembly to the canister wall with the washers and screws, after applying the minimum effective amount of locking compound, Loctite Grade A, to the screw threads.

NOTE: As the fitting of the valve assembly to the canister is a non-handed operation, it is recommended that the top two screws be engaged first to counteract the tendency of the spring to tilt the mounting.

(6) Evenly tighten the screws, removing any exuded locking compound. Using the right-angled torque spanner, torque-tighten the screws to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

E. Conclusion

(1) Carry out a Leakage Test of the non-return valve (Ref. Adjustment/Test).

(2) Install the pump element (Ref. para.2.).

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PUMP UNITS (TANKS 5, 6, 7 and 8) - ADJUSTMENT/TEST

1. General

Two pump units are installed in each of the main transfer tanks (5, 6, 7 and 8). Each unit consists of a pump element fitted to an isolation canister.

The pump elements are identical, but the canisters in tanks 5 and 7 are different in external shape from those in tanks 6 and 8. The forward pump in tank 8 and the aft pump in tank 6 each have a non-return valve fitted in the pump outlet and fuel is bled from their feed pipes to supply the associated tank de-aeration system.

Access to the pump units is gained by removing panels in the bottom of the fuselage.

The control switches and indicators for the pumps are disposed, in a fuel-flow pattern, on the fuel management panel at the third crew member's station.

The following procedures comprise a Functional Test of the pump element, followed by a Functional Test and a Leakage Test of the canister. Operational and System Tests are not required in this application.

2. Functional Test - Pump Element

A. Prepare to Test Pump Element

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Refuel, to high level capacity, the tank (Ref. 12-11-28) in which the pump is installed.

(4) Remove the appropriate pump element access panel (Ref. Removal/Installation).

B. Test Pump Element

(1) Set the PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated and then extinguished within 3 s, indicating that the pump is operating. Set the switch to "OFF".

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(2) With the pump inoperative, check that there is no external fuel leakage from the pump element for a duration of 15 min.

(3) Carry out a fuel flow rate test as follows:

(a) Ensure that the receiving tank associated with the pump does not contain more than 500 kg of fuel. Defuel (Ref. 28-25-00, Servicing) if necessary.

(b) Ensure that the NORM - AFT TRIM switch is set to NORM.

(c) Note the fuel quantity in the receiving tank.

(d) Set the PUMP switch to "ON" for 3 min then set it to "OFF". Check, by reference to the fuel quantity indicator of the receiving tank, that the quantity of fuel transferred is in accordance with the flow rate shown in Table 501.

TRANSFER SYSTEM TANK NOS.	PUMP POSITION	PUMP SWITCH	MINIMUM FLOW RATE (kg/min)
5 to 1	Forward	5 LH	320
5 to 2	Aft	5 RH	259
6 to 1	Forward	6 LH	249
6 to 2	Aft	6 RH	320
7 to 3	Aft	7 LH	324
7 to 4	Forward	7 RH	267
8 to 3	Aft	8 LH	257
8 to 4	Forward	8 RH	311

Fuel Flow Rates
Table 501

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(2) Fit the pump element access panel.

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3. Functional Test - Isolation Canister

A. Prepare to Test Canister

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Remove the pump element (Ref. Removal/Installation).

B. Test Canister

CAUTION: WET THE INLET SLEEVE SEAL WITH FUEL BEFORE OPERATING THE INLET SLEEVE.

(1) Push the inlet sleeve up to its full extent, then release it. Check for full and free movement in both directions and ensure that it shuts completely under spring pressure.

(2) Manually operate the flap relief valves and the fuel outlet non-return valve (if fitted). Check that they move fully and freely and close automatically.

C. Conclusion

(1) Carry out a Leakage Test of the canister (Ref. para.4.).

4. Leakage Test - Isolation Canister

A. Equipment and Materials

DESCRIPTION	PART NO.
Plug adapter assembly	E925116001
Fuel pressure test rig, capable of producing a pressure of 0 to 25 psig (0 to 1.72 bar)	-
Receptacle, 1 gal (4.5 l), for fuel leakage	-

B. Prepare to Test Canister

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

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(3) Remove the appropriate access panels to gain access to the canister (Ref. Removal/Installation) and the associated transfer control valve sensor (Ref. 28-22-11, Removal/ Installation.

(4) Remove the pump element (Ref. Removal/Installation).

(5) Fit the plug adapter in place of the pump element, and connect the test rig to the adapter.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(6) If tank 8 forward canister or tank 6 aft canister is under test, fit standard AN blanks in place of the de-aeration nozzles (Ref. 28-13-00, Adjustment/Test).

(7) Raise the float arm of the associated sensor (Ref. 28-22-11, Adjustment/Test), and secure it in this position to keep the transfer control valve closed.

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C. Test Canister

(1) Operate the fuel test rig and gradually pressurize the pipeline sufficiently to vent it of air, then to fill it completely with fuel.

NOTE: The float arm may be depressed a few times to assist with the venting, then resecured in the upward (valve closed) position, using nylon cord.

(2) Increase the pressure to 25 psig (1.72 bar).

(3) Enter the tank and check that there is no fuel leakage from the pipe-to-canister joints over a period of 10 min.

(4) Release the rig pressure.

(5) Disconnect the test rig and fit the blanking cap to the plug adapter immediately.

(6) Release the sensor float in the collector tank and remove the nylon cord.

(7) Remove the pipe blanks and refit the de-aeration nozzles (if applicable). Carefully examine all the holes in each nozzle and ensure that they are free from blockage.

(8) Place a clean receptacle beneath the canister to collect fuel leakage.

(9) Remove the plug adapter from the canister.

R (10) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (11) Refit the access panels removed in operation B.(3).

R (12) Refuel the tank to high level capacity (Ref. 12-11-28).

R (13) Check the canister valves for leakage of fuel. The total leakage from a canister with a non-return valve fitted must not exceed 83 cc/min. Leakage from a canister with only flap relief valves fitted must not exceed 7.5 cc/min.

R (14) Check, for a 15 min period, that there is no external fuel leakage from the tank access panel and the canister-to-tank joint.

D. Conclusion

(1) Remove the receptacle.

(2) Install the pump element (Ref. Removal/Installation).

(3) Remove the warning placards.

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END OF THIS SECTION

NEXT

PUMP UNITS (TANKS 5A AND 7A) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pump units are installed in each outer wing tank (5A and 7A). They are bolted horizontally on mounting plates which are bolted and sealed to the outside of a fuel sump outboard of each outer wing tank. Flap valves on the mounting plate allow removal of a pump element without draining the tank, but the tank must be drained before removal of a mounting plate. A drain plug enables the pump casing to be drained prior to pump removal.

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2. Pump Element (Ref. Fig.401)

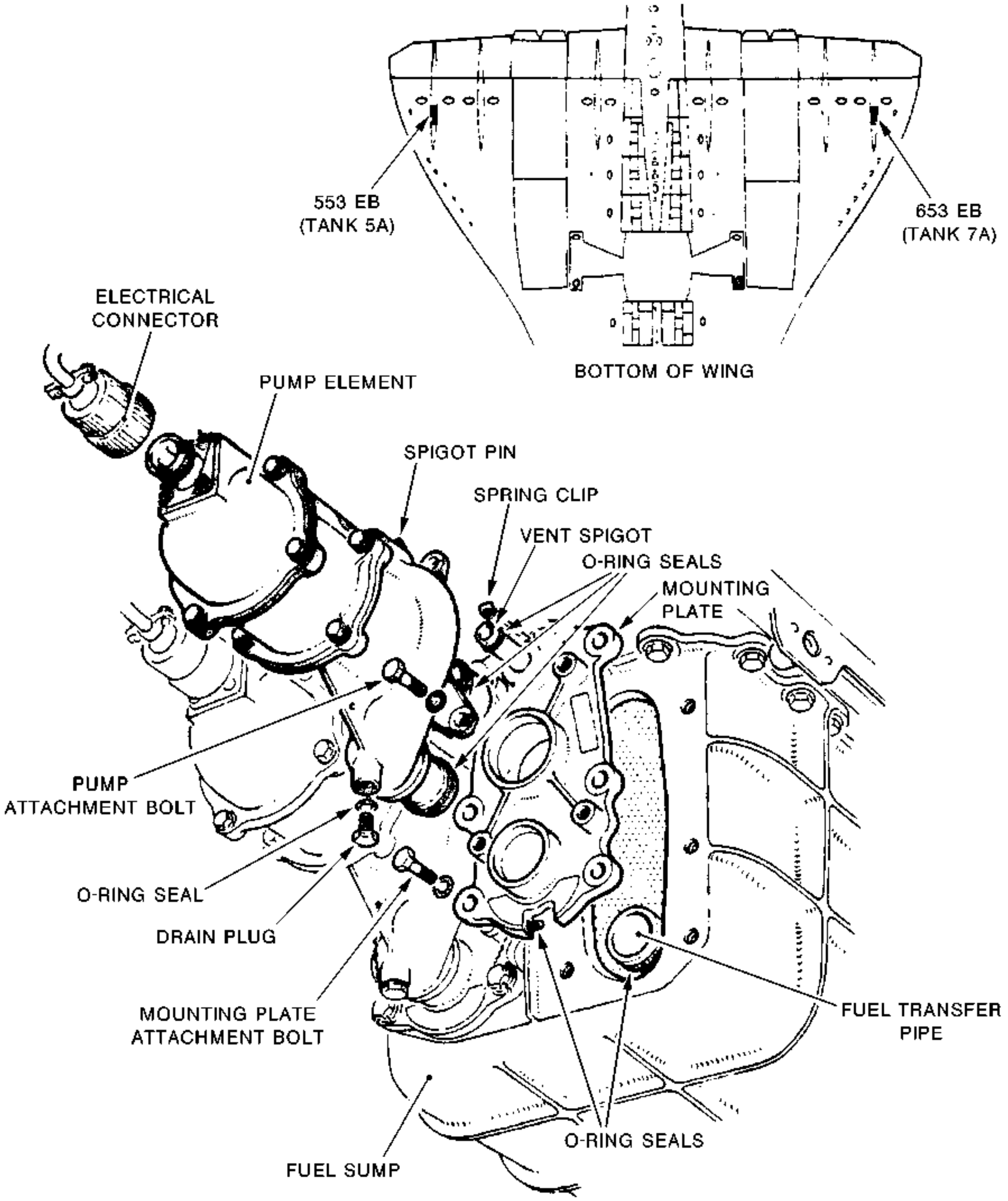
A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque spanner, 23 to 25 lbf in (0.26 to 0.282 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Receptacle, 1 gal (4.5 l), for fuel drainage	-

B. Prepare to Remove Pump Element

(1) Comply with the fuel and electrical safety precautions.

(2) Electrically isolate the appropriate pump by tripping the associated circuit breaker. Fit a safety clip.



Pump Unit - (Tanks 5A and 7A) - Installation
Figure 401

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5A INNER PUMP SUP	13-215	Q 902	A19
TANK 5A OUTER PUMP SUP	14-215	Q 901	E14
TANK 7A INNER PUMP SUP	13-216	Q 903	C 4
TANK 7A OUTER PUMP SUP	14-216	Q 904	D 4

(3) Remove panel 553 EB (tank 5A) or panel 653 EB (tank 7A), in the bottom surface of the outer wing, to gain access to the pump.

(4) Place a suitable receptacle in position to collect fuel which may drain from the pump element during removal.

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C. Remove Pump Element

(1) Disconnect the electrical connector from the pump element.

(2) Remove the wire-locking and slacken the drain plug sufficiently to facilitate subsequent removal.

(3) Remove the four bolts securing the pump element and slowly withdraw it until it is restrained by the spigot pin when it reaches the end of the slot in the spring clip secured to the mounting plate. Unscrew the drain plug and drain the fuel (approximately 2 pints (1 l)) from the pump element.

NOTE: A continuous fuel flow indicates that the inlet port flap valve is not closed, in which case the tank must be drained (Ref. 28-25-00, Servicing) and the inlet valve defect rectified.

(4) Lift the spring clip to disengage it from the spigot pin, and withdraw the pump element.

(5) Temporarily refit the drain plug to the pump.

(6) Fit a suitable blank to the outlet orifice in the mounting plate, and to the pump inlet and outlet spigots.

D. Prepare to Install Pump Element

NOTE: All O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the fuel and electrical safety precautions.

(2) Renew the drain plug O-ring seal, and refit the plug to the pump element. Torque-tighten the plug to between 23 and 25 lbf in (0.26 and 0.282 mdaN), and wire-lock it in accordance with 20-21-13.

(3) Renew the O-ring seal on the inlet and outlet spigots, and on the mounting plate vent spigot.

E. Install Pump Element

(1) Remove the blanks from the mounting plate and the pump.

(2) Position the pump element on the mounting plate, inserting the inlet, outlet, and vent spigots into their respective orifices. Lift the spring clip and push the element fully into position. Release the spring clip and ensure that the spigot pin is properly engaged in the slot.

(3) Fit the four attachment bolts and washers. Torque-tighten the bolts, in a diametrical sequence, to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(4) Check that the electrical bonding is in accordance with 20-27-11.

(5) Reconnect the electrical connector to the pump element, ensuring that the mating surfaces are clean and undamaged.

(6) Remove the safety clip and reset the circuit breaker tripped in operation 2.B.(2).

(7) Carry out a Functional Test of the pump element (Ref. Adjustment/Test).

(8) Fit the panel to the bottom surface of the outer wing.

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3. Pump Mounting Plate (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 40 to 49 lbf in (0.452 to 0.554 mdaN)	-

B. Prepare to Remove Mounting Plate

(1) Drain the tank from which the mounting plate is to be removed (Ref. 28-25-00, Servicing).

(2) Remove the pump element from the mounting plate (Ref. para.2.).

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C. Remove Mounting Plate

(1) Cut the locking wire and remove the six bolts and washers which secure the mounting plate to the tank sump. Remove the plate.

(2) Fit suitable blanks to the ports in the sump.

D. Prepare to Install Mounting Plate

(1) Remove the blanks from the ports in the sump.

(2) Examine the joint faces of the sump and the mounting plate, and ensure that they are clean and undamaged.

E. Install Mounting Plate

NOTE: All O-ring seals must be lubricated in accordance with 20-23-11 before installation.

R R (1) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R R R NOTE: Any bonding lead which is found to be broken, frayed, or loose in the crimp is to be replaced before the next flight.

R R R Bonding leads which show signs of corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (2) Manually check the valves on the mounting plate for full and free movement. Check that they seat correctly.

R (3) Insert a new O-ring seal into the groove on the mounting plate attachment flange.

R (4) Insert a new O-ring seal into the groove near the end of the fuel transfer pipe.

R (5) Place the mounting plate into position on the sump, so that the fuel transfer pipe is inserted into the outlet orifice in the plate.

R (6) Fit the six attachment bolts, with a washer positioned under each bolt head. Torque-tighten the bolts in a diametrical sequence to between 40 and 49 lbf in (0.452 and 0.554 mdaN). Wire-lock them in accordance with 20-21-13.

R (7) Refuel the tank (Ref. 12-11-28) and check the valves on the mounting plate for freedom from leaks. Check that there is no leakage from the mounting plate-to-sump joint.

F. Conclusion

(1) Install the pump element (Ref. para.2.D. and 2.E.).

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PUMP UNITS (TANKS NO.5A AND 7A) - ADJUSTMENT/TEST

1. General

Tanks 5A and 7A each have two motor driven pumps fitted externally to mounting plates on sumps beneath the respective tanks; each pump has a pressure switch and NRV in its outlet. The control switches and indicators for the pumps are located on the fuel management panel at the 3CM station.

2. Pump Element

A. Prepare to Test Pump Element

(1) Check and ensure that all main transfer system pump switches on the fuel management panel are set at OFF.

(2) Make available electrical ground power.

(3) Remove the relevant section of underwing fairing (Ref. 28-22-22 Removal/Installation) from the outer wing to obtain access to the pump.

(4) Refuel tank 5A or 7A, as appropriate, to full capacity.

R (5) Set the appropriate TRANS VALVE 5A-5 or 7A-7 switch on the fuel management panel to "ON".

B. Function Test

(1) Set the pump switch to "ON", check that the associated LOW PRESS caption light illuminates and then extinguishes within 3 seconds, indicating that the pump is operating. Set the switch to "OFF".

NOTE: Each pump in an outer wing tank has a separate operating switch and pressure switch, but one LOW PRESS caption light serves for both pumps.

(2) Check the pump fuel flow:

(a) Check the contents indicator of the associated main transfer tank which will receive the fuel from the pump undergoing test, and ensure that this tank does not contain more than 4970 kg (No. 5 tank) or 5250 kg (No. 7 tank).

(b) Set the pump switch to "ON". Observe the associated contents indicator and check that,
R during a minimum duration of 3 min, the fuel

R transfer flow rate is not less than 73 kg/min
R (tank 5A pump) or 81 kg/min (tank 7A pump).

(c) Set the pump switch to "OFF".

(d) Set the TRANS VALVE switch to "OFF".

C. Leak Test

(1) Refuel tank 5A or 7A, as appropriate, to full capacity.

(2) With the pump inoperative check for external leaks for a duration of 15 minutes. No leakage is acceptable.

3. <u>Pump Mounting Plate</u>

A. Prepare to Test Mounting Plate

(1) Defuel the tank in which the mounting plate is installed.

(2) Remove the pump element from the mounting plate.

B. Function Test

(1) Operate the flap valves manually and check that they move freely and close correctly.

C. Leak Test

(1) Refuel the tank to full capacity.

(2) Check for leakage past the flap valves. To be acceptable leakage (if any) must not exceed 1.5 gal (6.82 litres) per hour.

(3) Install the pump element. With the pump inoperative check for 15 minutes for leakage between the sump, mounting plate and pump interface joints; no leakage is acceptable.

D. Conclusion of Test

(1) Functionally test the pump element.

(2) Switch off and disconnect electrical ground power.

(3) Refit the section of underwing fairing to the outer wing.

PUMP PRESSURE SWITCH - REMOVAL/INSTALLATION

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

R There is one pressure switch connected to each of the transfer
R pumps in tanks 5, 6, 7, 8, 5A and 7A. Each switch is
R bracket-mounted to the lower external surface of the tank
R near the associated pump.

2. Pressure Switch (Ref. Fig. 401)

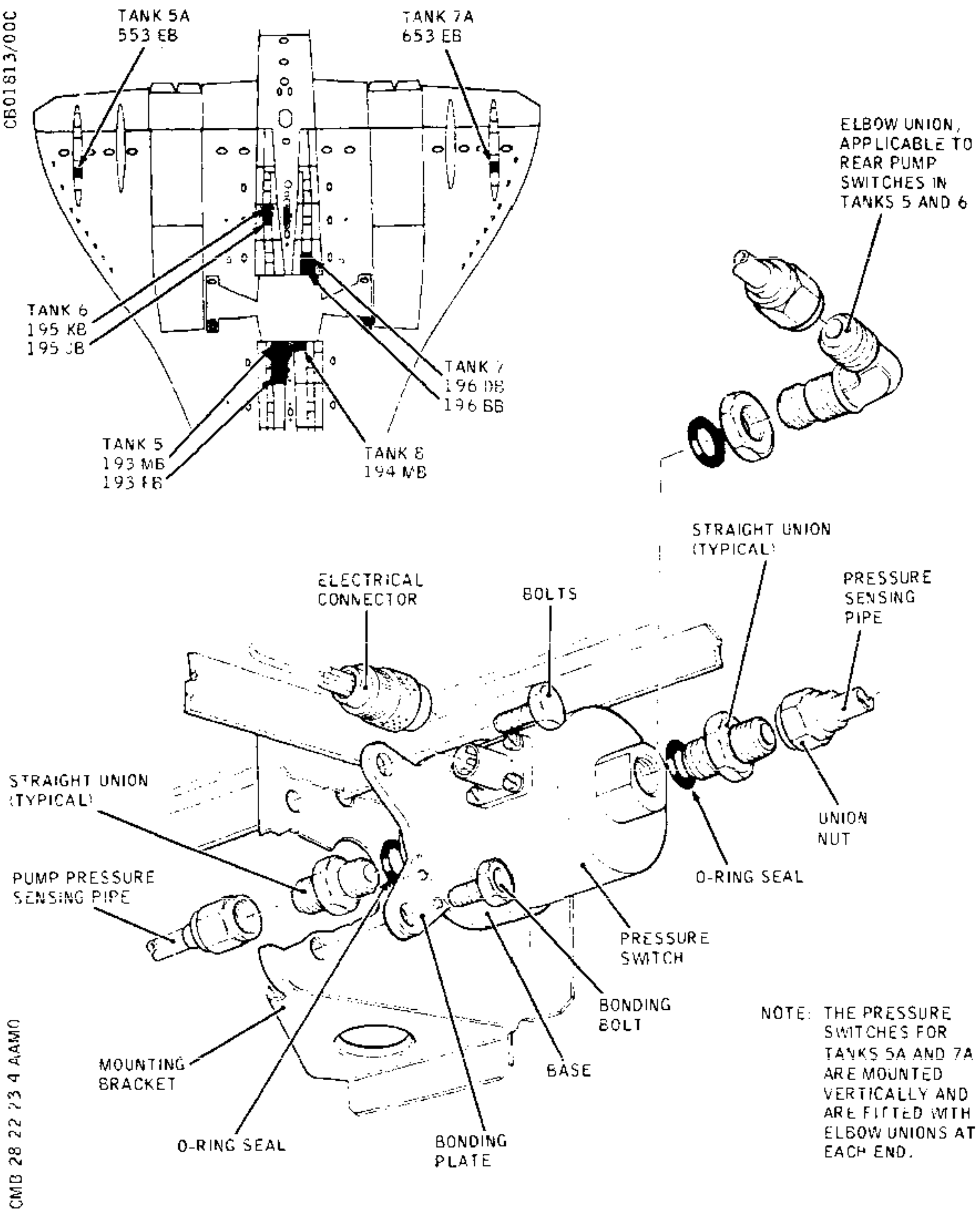
A. Equipment and Materials

R

R	DESCRIPTION	PART NO.
R		
	Circuit breaker safety clips	-
R R	Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
R R	Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
R R	Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
R R	Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
R R	Container, 1.75 pints (1 l), for fuel spillage	-
R		

R B. Prepare

(1) Electrically isolate the pressure switch and the
R associated pump by tripping the appropriate circuit
R breakers; fit safety clips.



R - Pump Pressure Switch - Installation
Figure 401

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Tank 5 forward pump:			
TANK 5-1 PUMP SUP	4-213	Q905	D5
TANK 5-1 PUMP NORM CONT	14-216	Q897	C4
TANK 5-1 PUMP EMER CONT	4-213	Q898	D3
TANK 5-1 PUMP IND	15-216	Q893	A5
Tank 5 rear pump:			
TANK 5-2 PUMP SUP	13-215	Q906	E19
TANK 5-2 PUMP IND	15-215	Q894	C24
Tank 6 forward pump:			
TANK 6-1 PUMP SUP	14-215	Q911	G17
TANK 6-1 PUMP IND	15-215	Q895	C25
Tank 6 rear pump:			
TANK 6-2 PUMP SUP	13-216	Q912	F1
TANK 6-2 PUMP IND	15-216	Q896	A6
Tank 7 rear pump:			
TANK 7-3 PUMP SUP	4-213	Q908	C8
TANK 7-3 PUMP NORM CONT	13-216	Q899	E5
TANK 7-3 PUMP EMER CONT	4-213	Q900	C3
TANK 7-3 PUMP IND	15-216	Q893	A5
Tank 7 forward pump:			
TANK 7-4 PUMP SUP	14-215	Q907	E17

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 7-4 PUMP IND	15-215	Q894	C24
Tank 8 rear pump:			
TANK 8-3 PUMP SUP	13-215	Q910	G19
TANK 8-3 PUMP IND	15-215	Q895	C25
Tank 8 forward pump:			
TANK 8-4 PUMP SUP	14-216	Q909	D1
TANK 8-4 PUMP IND	15-216	Q896	A6
TANK 5A-5 OUTER PUMP SUP	14-215	Q901	E14
TANK 5A-5 INNER PUMP SUP	13-215	Q902	A19
TANK 5A PUMPS IND	15-215	Q891	C23
TANK 7A-7 OUTER PUMP SUP	14-216	Q904	D4
TANK 7A-7 INNER PUMP SUP	13-216	Q903	C4
TANK 7A PUMPS IND	15-216	Q892	A7

(2) Remove the appropriate access panel (Ref. Fig. 401) to gain access to the pressure switch.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

NOTE: Before operation (2) a suitable container must be positioned to collect fuel which will flow from the disconnected pipes. Pressure-tight blanks must be fitted to the pipe-ends immediately.

(2) Disconnect the pressure sensing pipes from each end

R of the switch and fit suitable blanks to the pipes.

R (3) Remove the three bolts and washers which secure the
R pressure switch to the mounting bracket; note the
R position of the bonding plate on the switch
R attachment flange and the special bonding bolt.

R (4) Remove the union and O-ring seal from each end of
R the pressure switch. Discard the O-ring seals and
R fit suitable blanks to the switch.

D. Install

(1) Observe the fuel and electrical safety precautions.

R (2) Remove the blanks from the pressure switch.

R (3) Secure the pressure switch to the mounting bracket
R with the three attachment bolts and washers, ensuring
R that the bonding bolt and bonding plate are correctly
R positioned; torque-tighten each bolt to between 40
R and 45 lbf in (0.452 and 0.508 mdaN).

R (4) Fit the nuts (if applicable) and new O-ring seals,
R lubricated in accordance with 20-23-11, to the
R unions.

R (5) Fit the appropriate unions to each end of the
R pressure switch as follows:-

R (a) Fit a straight union to the switch and torque-
R tighten it to between 107 and 117 lbf in
R (1.209 and 1.322 mdaN).

R (b) Fit an elbow union and nut to the switch as
R detailed in 28-22-12, Figure 403 - 'Sensing
R Pipe - Adapter Installation'. Torque-tighten
R the nut to between 107 and 117 lbf in (1.209 and
R 1.322 mdaN).

R (6) Remove the blanks from the pressure sensing pipes and
R connect the pipes to the pressure switch.

R (7) At the base of the switch, torque-tighten the pipe
R union nut to between 40 and 65 lbf in (0.452 and
R 0.734 mdaN).

R (8) At the other end of the switch, torque-tighten the
R pipe union nut to between 60 and 80 lbf in
R (0.678 and 0.904 mdaN).

R (9) Ensure that the electrical bonding is in accordance
R with 20-27-11.

R (10) Connect the electrical connector to the pressure
R switch, ensuring that the mating surfaces are clean
R and undamaged.

R E. Conclusion

R (1) Remove the safety clips and reset the circuit
R breakers previously tripped.

R (2) Carry out an Operational Test and a Leakage Test
R of the switch (Ref. Adjustment/Test).

R (3) Refit the access panel.

PUMP PRESSURE SWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Low output pressure from a transfer pump is sensed by an associated pressure switch which effects illumination of a caption on the fuel management panel, at the third crew member's (3CM) position.

Each pump in tanks 5A and 7A has an individual pressure switch but, for each of these tanks, both pressure switches operate a common LOW PRESS caption.

The pressure switches for tanks 5A and 7A pumps are each mounted on a bracket secured to the tank sump. The pressure switch for each pump in tanks 5, 6, 7 and 8 is bolted to a bracket on the structure near the associated pump.

This topic comprises an Operational Test and a Leakage Test of the pressure switch. Functional and System Tests are not applicable.

2. Operational Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Check, by reference to the fuel quantity indicator, that the tank associated with the pressure switch contains fuel.

B. Test

(1) Set the associated PUMP switch to "ON" and check that its LOW PRESS caption is illuminated and then extinguished after 3 s, indicating the correct build-up of pump pressure.

(2) Trip the pump circuit breaker (Ref. Removal/

Installation) to simulate pump failure and check that the LOW PRESS caption is illuminated after 3 s.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Reset the pump circuit breaker.

3. Leakage Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Refuel the tank (Ref. 12-11-28) to high level capacity.

(4) Remove the appropriate access panel (Ref. Removal/Installation).

B. Test

(1) Set the associated PUMP switch to "ON" and check that its LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(2) Observe the pressure switch and check that, over a minimum period of 5 min, there is no fuel leakage from the pipe joints.

(3) Set the PUMP switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Refit the access panel.

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INTERCONNECT VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

One valve is installed in a pipe which connects tanks 5 and 8, and another is similarly installed between tanks 6 and 7. The valves normally remain closed, but if both transfer pumps in a tank fail, the appropriate valve can be opened so that fuel is transferred by gravity flow, in either direction to or from the fuselage cell of the interconnected tank.

A valve element can be removed with fuel in the tank, but a tank must be drained before a valve canister is removed.

This topic comprises removal/installation procedures for a valve element, a valve motor and a canister.

2. Valve Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 1 pint (0.568 l) capacity	-

B. Prepare to Remove Valve Element

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Attach warning placards to the fuel management and refuel control panels, indicating that the settings of the switches must not be altered.

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(3) Electrically isolate the valve by tripping the appropriate circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5-8 INTER-CON VALVE SUP & IND	3-213	Q 871	B 7
TANK 6-7 INTER-CON VALVE SUP & IND	1-213	Q 872	L12

(4) Open the appropriate access panel in the bottom surface of the fuselage (Ref. Fig.401).

C. Remove Valve Element

(1) Remove the bolt and washer securing the bonding lead to the structure.

(2) Disconnect the electrical connector from the valve element.

CAUTION: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMPING NUT STUDS, DO NOT SLACKEN THE CLAMPING NUTS MORE THAN TWO TURNS.

(3) Slacken the clamp nuts by not more than two turns.

(4) Rotate the valve element clockwise through 90 deg and align the cut-outs in the valve body with the clamp nuts.

(5) Position the container under the drain plug and remove the drain plug. Allow fuel (approximately 1 pint (0.568 l)), to drain from the valve.

(6) Withdraw the valve element from the canister. Refit the drain plug to the valve element.

(7) Remove and discard the O-ring seal from the valve element.

(8) Fit a suitable blank to the canister aperture.

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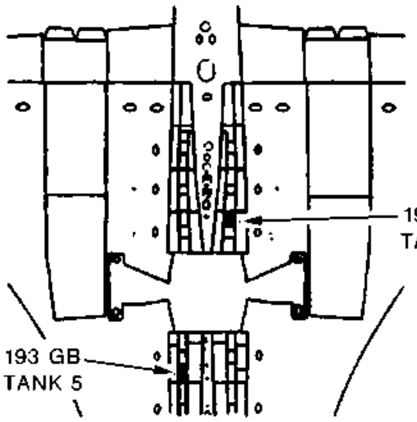
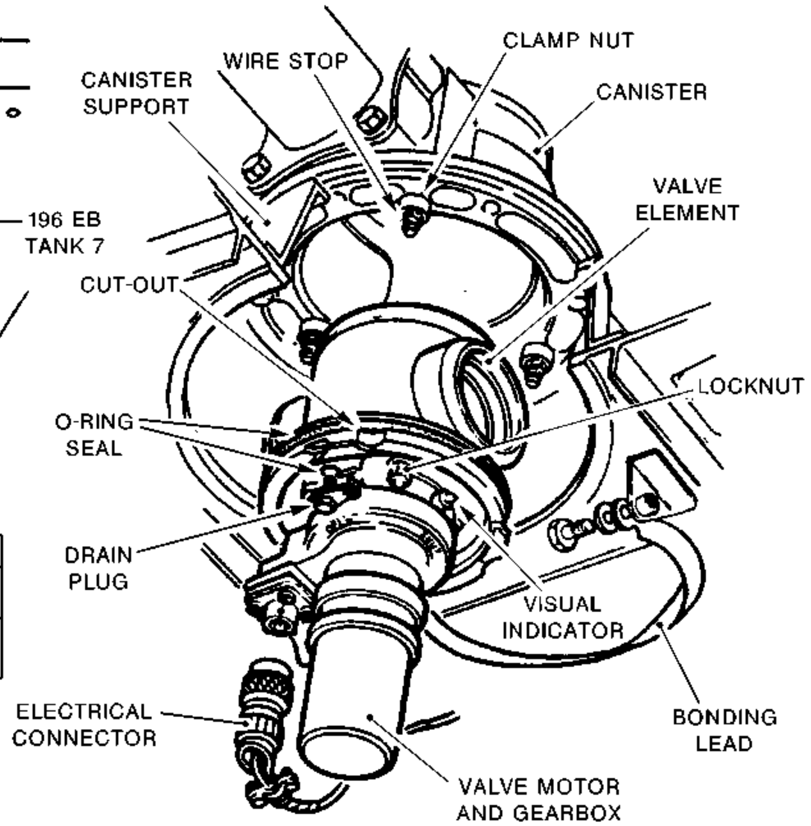
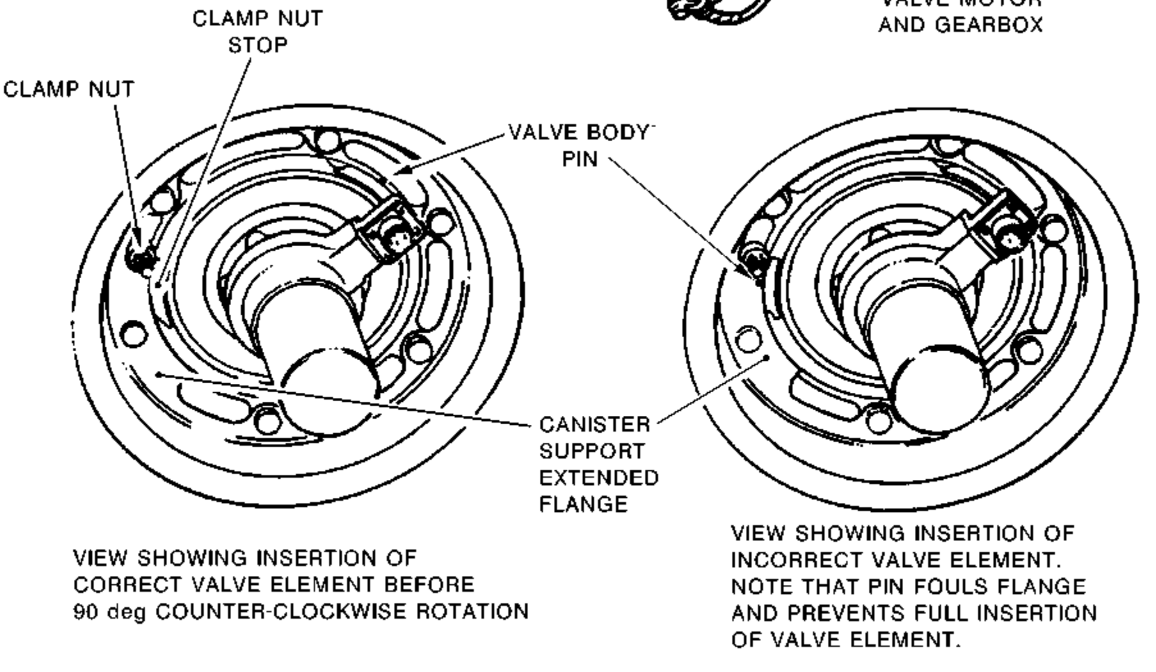


TANK NO.	5	7
ELECT. IDENT.	Q877	Q878
ELECTRICAL IDENT. AND ASSOCIATED TANK NOS.		





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Valve Element - Installation
Figure 401

D. Prepare to Install Valve Element

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the drain plug and fit a new O-ring seal. Refit the drain plug hand-tight only.

(2) Fit a new O-ring seal to the valve element.

(3) Remove the blank from the canister aperture.

E. Install Valve Element

(1) Comply with the electrical and fuel safety precautions.

(2) Insert the valve element into the canister. Ensure that the valve body cut-outs are aligned with the clamp nuts and push the valve element firmly and fully into the canister.

NOTE: The interconnect valve element is similar to a 2 in fuel valve element. The refuel valve element is fitted with a non-return valve, but the interconnect valve element does not have a non-return valve. Therefore, a small pin on the periphery of the valve body ensures installation of the correct valve element. If the pin fouls an extension of the top flange in the canister support (Ref. Fig. 401), an incorrect valve element is being used.

(3) Rotate the valve element counter-clockwise through 90 deg.

(4) Torque-tighten the clamp nuts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Torque-tighten the drain plug to between 10 and 14 lbf in (0.113 and 0.158 mdaN).

(6) Secure the bonding lead to the structure bracket with the washer and bolt. Torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(7) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

(8) Check the bonding of the valve element installation in accordance with 20-27-11.

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F. Conclusion

(1) Reset the circuit breaker previously tripped.

(2) Carry out Functional, Flow and Leakage Tests of the valve element (Ref. Adjustment/Test).

(3) Remove the warning placards from the fuel management and refuel control panels.

(4) Refit the access panel.

3. Valve Motor (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Remove the valve element (Ref. para.2.).

C. Remove Valve Motor

(1) Remove the locknuts securing the motor to the four studs on the valve body.

(2) Remove the motor from the valve body.

D. Prepare to Install Valve Motor

(1) Check that the mating faces of the valve body and motor and the splined drives of the motor and valve body are clean and undamaged.

E. Install Valve Motor

(1) Align the master splines and locating dowel and assemble the motor to the valve body with the four locknuts.

(2) Torque-tighten the four locknuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

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F. Conclusion

(1) Refit the valve element to the canister (Ref. para.2.).

4. Canister (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

B. Prepare to Remove Canister

(1) Defuel and drain (Ref. 25-00-00, Servicing) both tanks which are interconnected by the canister, i.e., tanks 5 and 8 or tanks 6 and 7.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed. Place placards at both panels warning that the settings of the switches must not be altered.

(3) Remove the interconnect valve element (Ref. para.2.).

(4) Remove the appropriate tank access panel in the bottom surface of the fuselage.

C. Remove Canister

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) If the canister is in tank 5, remove the bolt and washer securing the electrical bonding lead to the bracket on the tank wall.

(2) Noting the location of the special bonding bolt, (canister and bonding lead attachment) remove the canister attachment bolts and washers.

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(3) From inside the tank remove the canister from its mounting, at the same time withdrawing the interconnecting pipe from the aperture in the tank wall. Remove and discard the O-ring seal from the canister joint face.

(4) Unlock the bolts securing the interconnecting pipe flange fitting to the canister. Remove the bolts and washers.

(5) Remove the interconnecting pipe from the canister. Remove and discard the O-ring seals from each end of the pipe.

D. Install Canister

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals, lubricated in accordance with 20-23-11, in the grooves at the end of the interconnecting pipe.

(3) Ensure that the snap ring is located in the recess of the flange fitting on the interconnect pipe.

(4) Fit the flanged end of the pipe to the canister port, locating the flange against the face of the port.

(5) Fit the flange attachment bolts and washers, securing the bonding lead with the special bolt.

(6) Torque-tighten the attachment bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(7) Lock the bolts together in pairs with locking wire in accordance with 20-21-13.

(8) Fit a new O-ring seal, lubricated in accordance with 20-23-11, into the groove in the canister mounting face.

(9) Position the canister on the mounting face in the tank, inserting the interconnecting pipe into the aperture in the tank wall.

(10) Fit the canister attachment bolts and washers. Torque-tighten the attachment bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(11) Lock the bolts together in pairs with locking wire in accordance with 20-21-13.

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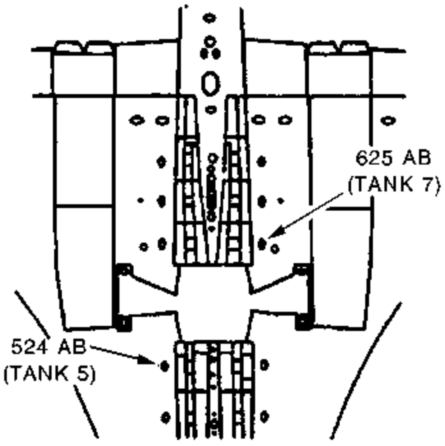
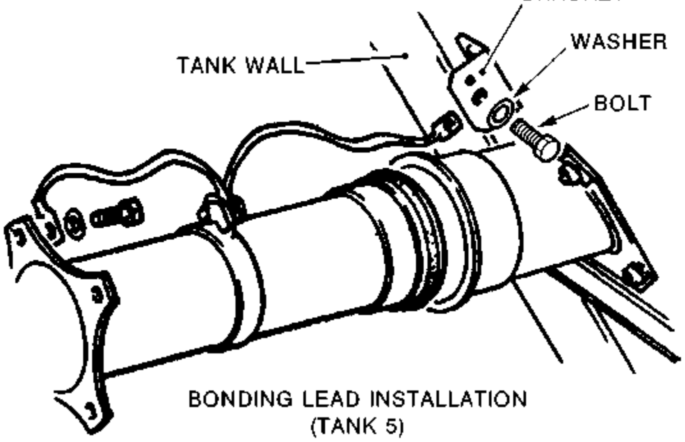
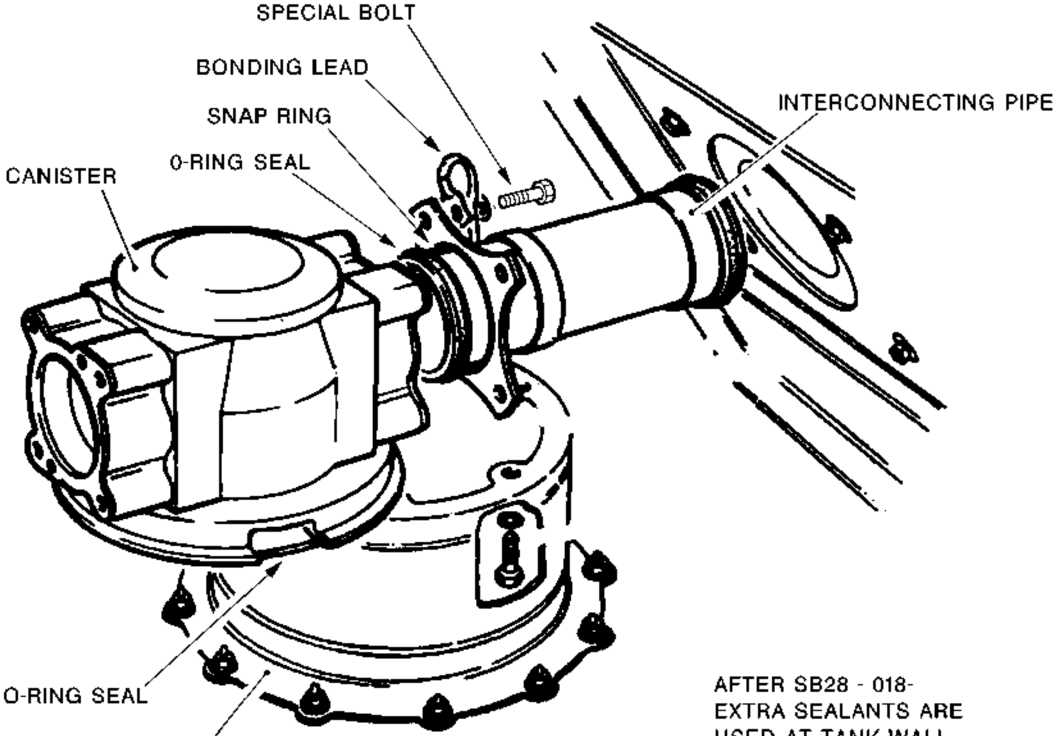


BOTTOM OF WING



BONDING LEAD INSTALLATION
(TANK 5)



TANK 7 INSTALLATION
(TANK 5 SIMILAR)

AFTER SB28 - 018-
EXTRA SEALANTS ARE
USED AT TANK WALL
AND TANK FLOOR JOINTS

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CMB 28 22 24 4 BAM0 00

Canister - Installation
Figure 402

(12) Attach the bonding lead to the bracket on the tank wall, and secure it with a bolt and a washer. Torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(13) Check that the electrical bonding is in accordance with 20-27-11.

E. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) Fit the tank access panel (Ref. 57-00-00, Removal/ Installation).

R (3) Refuel the tanks (Ref. 12-11-28) and check for freedom from leakage around the tank access panel.

R (4) Carry out a Leakage Test of the canister sleeve and joints (Ref. Adjustment/Test).

R (5) Install the valve element (Ref. para.2.).

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INTERCONNECT VALVE - ADJUSTMENT/TEST

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN
R 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN
R 24-00-00.

R 1. General

R There is one interconnect valve in tank 5 and one in tank 7.
R They are connected to short pipes leading to tanks 8 and 6
R respectively. When a valve is opened, it allows gravity
R fuel flow, in either direction, from one interconnected
R tank to another.

R Each valve comprises an electrically operated valve element
R fitted into an isolation canister.

R Control switches and indicators for the valves are located
R on the fuel management panel at the third crew member's
R station. Each switch has two settings, OPEN and SHUT, and
R is normally set to SHUT.

R The following procedures comprise a Functional Test of the
R valve element, a Flow Test of the valve, and a Leakage Test
R of the canister.

R 2. Functional Test - Valve Element

R A. Prepare

R (1) Ensure that all fuel management panel switches are
R at their normal ground settings (Ref. 28-00-00,
R Servicing).

R (2) Make available electrical ground power as detailed
R in 24-41-00.

R (3) Open the appropriate panel to gain access to the
R valve element (Ref. Removal/Installation).

R B. Test

R (1) On the fuel management panel, set the appropriate
R INTER-CON VALVE switch (6-7, or 5-8) to "OPEN".
R Check that -

R (a) the valve opens within 3 s of the operation of
R the switch,

(b) the associated magnetic indicator on the fuel management panel displays diagonal stripes and then OPEN and

(c) the mechanical indicator on the valve indicates OPEN.

(2) Set the switch to "SHUT" and check that -

(a) the valve shuts within 3 s of the operation of the switch,

(b) the associated magnetic indicator displays diagonal stripes and then SHUT and

(c) the mechanical indicator on the valve indicates SHUT.

C. Conclusion

(1) Fit the access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. <u>Flow Test - Valve</u>

A. Prepare

(1) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that tank 8 (or 6) is full and tank 5 (or 7) is empty.

(4) Ensure that the refuel control panel access door is closed.

(5) Open the appropriate panel to gain access to the valve element (Ref. Removal/Installation).

B. Test

(1) Note the fuel quantity indicator (FQI) readings of the associated tanks (8 and 5, or 6 and 7).

(2) Set the appropriate INTER-CON VALVE switch to

"OPEN"; check that the associated magnetic indicator displays diagonal stripes and then OPEN.

(3) After 5 min, set the INTER-CON VALVE switch to "SHUT"; check that the indicator displays SHUT.

(4) Check, by reference to the FQIs, that the quantity of fuel transferred during the 5 min period is at least -

(a) 900 kg from tank 8 to 5, or

(b) 1,000 kg from tank 6 to 7.

(5) Check a reverse flow of fuel through the valve as follows:-

(a) Ensure that tank 5 (or 7) is full and tank 8 (or 6) is empty.

(b) Open the valve for a period of 5 min as in operations (2) and (3) and check, by reference to the FQIs, that there is a reverse flow of fuel.

NOTE: It is unnecessary to check the flow rate.

(6) During these tests, carry out a visual check of the valve element and canister joints for freedom from leakage.

C. Conclusion

(1) Fit the access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test - Valve Canister

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel drain tool, for water drain valves	D925374000
Container, for fuel leakage	-

B. Prepare

WARNING: OBSERVE THE AIRCRAFT OVERBALANCE PRECAUTIONS DETAILED IN 28-25-00, SERVICING.

(1) Refuel (Ref. 12-11-28) to high level both the associated tanks (8 and 5, or 6 and 7), as applicable.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Remove the valve element (Ref. Removal/Installation).

(4) Position a clean container to collect fuel leakage from the canister.

C. Test

CAUTION: DO NOT OPERATE THE CANISTER SLEEVE BY HAND.

(1) Check that the fuel leakage from the canister sleeve does not exceed 7.6 ml/min.

(2) Defuel and drain (Ref. 28-25-00, Servicing) the tank in which the canister is fitted (tank 5 or 7, as appropriate).

(3) Using the fuel drain tool, operate the lowest water drain valve in the empty tank (Ref. 28-11-11, Removal/Installation) and check that, over a period of 15 min, there is no fuel flow from the drain valve. A flow would indicate a leaking pipe-to-canister connection.

D. Conclusion

(1) Install the valve element (Ref. Removal/Installation).

(2) Carry out a Functional Test of the valve element (Ref. para.2.).

NON-RETURN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Each transfer pump in the outer wing tanks has a removable non-return valve; in each instance the valve is installed in an outlet manifold on the tank sump. If an outer wing tank transfer pump is inoperative, the associated non-return valve prevents a reverse flow of fuel into the respective tank.

2. Non-return Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 11 to 13 lbf in (0.124 to 0.147 mdaN)	-
Bolt, 5/16 in UNF, to facilitate removal of valve	A102-159 (or equivalent)

B. Prepare

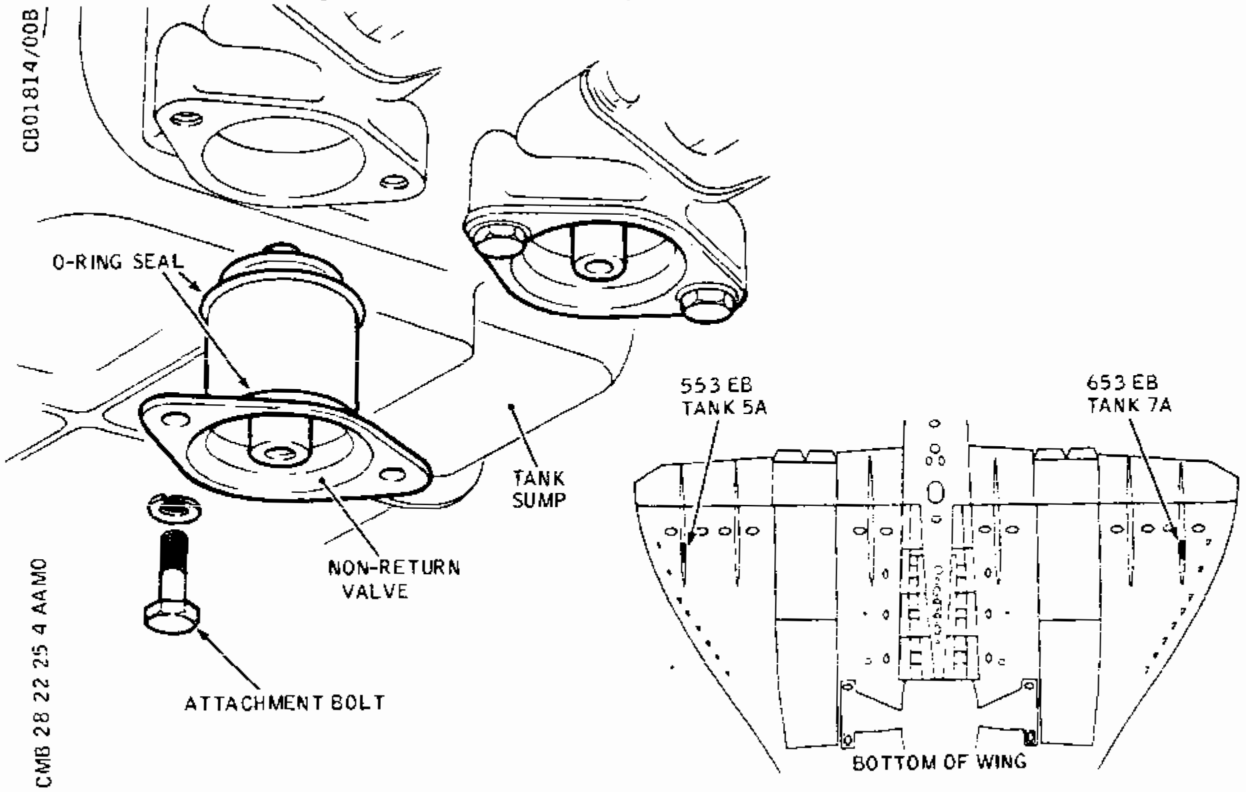
(1) Drain the tank in which the valve is installed, either by transferring fuel into the associated main transfer tank (Ref. 28-00-00, Servicing) or by defuelling the tank (Ref. 28-25-00, Servicing).

(2) Electrically isolate both pumps in the tank by tripping the appropriate circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5A OUTER PUMP SUP	14-215	Q901	E14
TANK 5A INNER PUMP SUP	13-215	Q902	A19

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 7A OUTER PUMP SUP	14-216	Q904	D4
TANK 7A INNER PUMP SUP	13-216	Q903	C4

(3) Remove the appropriate access panel in the outer wing bottom surface, for access to the valve.



Non-return Valve - Installation
Figure 401

C. Remove

(1) Remove the two attachment bolts and washers.

(2) Screw a 5/16 in UNF bolt into the threaded hole in the centre of the valve body lower face. Grip the bolt and pull it to extract the valve from the tank sump.

(3) Remove the bolt from the valve body.

(4) Remove and discard the O-ring seals from the valve body.

(5) Fit a suitable blank over the valve aperture in the tank sump.

R D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Manually operate the valve plate and check that it
R moves freely and seats correctly under spring
R pressure.

R (3) Fit new O-ring seals, lubricated in accordance with
R 20-23-11, into the grooves in the valve body.

R NOTE: To ensure correct orientation of the valve, the
R attachment bolt holes are offset.

R (4) Remove the blank from the valve aperture in the tank sump. Insert the valve into the aperture and push it fully in. Fit the two attachment bolts and
R washers; torque-tighten the bolts to between 11 and
R 13 lbf in (0.124 and 0.147 mdaN).

R E. Conclusion

R (1) Remove the safety clips and reset the circuit breakers
R previously tripped.

R (2) Carry out an Operational Test and a Leakage Test of
R the valve (Ref. Adjustment/Test).

NON-RETURN VALVE - ADJUSTMENT/TEST

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN
R 24-00-00.

1. General

Each of the two pumps in the outer wing tanks (tanks 5A and 7A) has a non-return valve in its outlet manifold. The valve is tested to ensure that it does not impede fuel flow from the pump to which it is installed, and that it does not reduce the output of the second pump, by permitting a reverse flow, when the pump to which it is installed is inoperative.

R An Operational Test and a Leakage Test of a non-return valve
R are detailed in the following procedures. Functional and
R System Tests are not applicable.

R 2. Operational Test

R A. Prepare

R (1) Ensure that all fuel management panel switches
R are at their normal ground settings (Ref. 28-00-00,
R Servicing).

R (2) Make available electrical ground power as detailed
R in 24-41-00.

R (3) Ensure, by reference to the fuel quantity indicators
R (FQIs), that -

R (a) the appropriate tank (5A or 7A) contains
R sufficient fuel for the test, and

R (b) the associated main transfer tank (5 or 7) does
R not contain more than 5,000 kg of fuel.

R B. Test

R (1) Record the readings on the appropriate FQIs
R (tanks 5A and 5 or 7A and 7).

R (2) Set the associated transfer shut-off valve switch
R (TRANS VALVE 5A - 5 or TRANS VALVE 7A - 7) to "OPEN".

R (3) Set the PUMP switch, associated with the non-return
R valve, to "ON" (Ref. Table 501) and check that the
R LOW PRESS caption is illuminated and then

extinguished within 3 s as pump pressure builds up.

PUMP SWITCH	ASSOCIATED PUMP
Tank 5A LH switch	Tank 5A outer pump
Tank 5A RH switch	Tank 5A inner pump
Tank 7A LH switch	Tank 7A inner pump
Tank 7A RH switch	Tank 7A outer pump

Pump Switches and Associated Pumps
Table 501

(4) Observe the associated FQIs and, for a duration of 3 min, check that the fuel transfer flow rate
R is not less than 73 kg/min (tank 5A-5) or
R 81 kg/min (tank 7A - 7).

(5) Set the pump switch to "OFF".

(6) With the switch for the pump delivering fuel through the non-return valve to be tested set to "OFF", set the other pump switch for the same tank to "ON" and observe the FQIs for the associated tanks. Check that, for a duration of 3 min, the
R fuel transfer flow rate is not less than 73 kg/min
R (tank 5A - 5) or 81 kg/min (tank 7A - 7).

NOTE: This test is made to check that a reverse flow does not occur when one of the two pumps for each of tanks 5A and 7A is inoperative.

(7) Set the pump switch to "OFF".

(8) Set the associated transfer shut-off valve switch to "SHUT".

E. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test

A. Prepare

(1) Check that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Remove the appropriate panel in the bottom surface of the outer wing, 553 EB (tank 5A) or 653 EB (tank 7A), to gain access to the non-return valve.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Ensure that tank 5A or 7A, as appropriate, contains sufficient fuel for the test.

B. Test

(1) Ensure that the appropriate TRANS VALVE switch, 5A - 5 or 7A - 7, is set to SHUT and that the associated indicator displays bar-across-line.

(2) Set the associated tank 5A or 7A pump switch to "ON" and check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up. Observe the FQIs and check that there is no fuel flow, indicating that the transfer shut-off valve is closed.

(3) At the bottom surface of the outer wing, check that there is no external leakage from the non-return valve over a period of 5 min.

(4) Set the pump switch to "OFF".

C. Conclusion

(1) Refit the access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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TRANSFER SHUT-OFF VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

One valve is installed in the fuel transfer pipe connecting tanks 7A and 7, and is located on the rear wall of tank 7. The other valve connects tanks 5A and 5 and is located on the rear wall of tank 6.

Each valve assembly comprises a motorized valve element, housed in a canister which is bolted to the tank wall. This topic includes the removal/installation procedures for the valve and the canister. The valve element can be removed from the canister without draining the fuel tank but, to remove the canister, it is necessary to drain the tank in which it is installed.

The transfer shut-off valve is mounted next to the refuel inlet valve, which is the same type of 1 in valve. Of each pair of valves, the outboard valve is the transfer shut-off valve.

2. Valve Element (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 1 pint (0.568 l) capacity	-

B. Prepare to Remove Valve Element

R R R R (1) Ensure that all fuel management panel switches are at their normal ground settings; display a placard warning that the settings of the switches must not be changed.

(2) Electrically isolate the valve by tripping the appropriate circuit breakers. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5A-5 TRANS VALVE SUP & IND	15-215	Q6668	G24
TANK 5A INNER PUMP SUP	13-215	Q902	A19
TANK 5A OUTER PUMP SUP	14-215	Q901	E14
TANK 7A-7 TRANS VALVE SUP & IND	15-216	Q6669	F7
R TANK 7A INNER PUMP SUP	13-216	Q903	C4
TANK 7A OUTER PUMP SUP	14-216	Q904	D4

R R (3) Gain access to the valve element by removing the appropriate access panel (Ref. Fig. 401).

R C. Remove Valve Element

R R (1) Remove the bolt and washer securing the bonding lead to the structure.

R R (2) Disconnect the electrical connector from the valve element.

R R R <u>CAUTION</u>: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMPING NUT STUDS, DO NOT SLACKEN THE CLAMPING NUTS MORE THAN TWO TURNS.

R (3) Slacken the clamp nuts by not more than two turns.

R (4) Position the container under the drain plug and

remove the drain plug.

NOTE: The drain plug must be removed before the valve element is rotated, otherwise the drain plug locking plate will foul the clamping nuts.

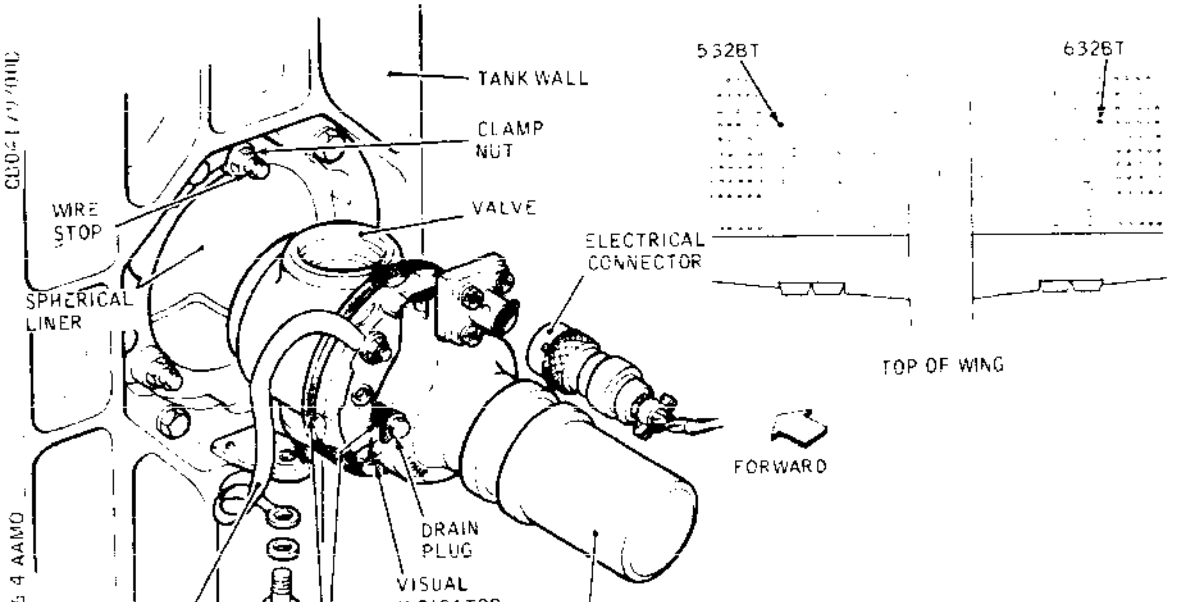
(5) Rapidly rotate the valve element clockwise through 90 deg and align the cut-outs in the valve body with the clamp nuts.

NOTE: Some fuel will drain when the element is rotated.

(6) Immediately pull the valve element from the canister. Refit the drain plug to the valve element.

(7) Remove and discard the O-ring seal from the valve element flange.

(8) Fit a suitable blank to the canister aperture.



TANK No.	6(FOR 5A AND 5)	7(FOR 7A AND 7)
ELECT. IDENT.	Q6682	Q6681

VALVE ELEC. IDENT. AND ASSOCIATED TANK NOs.

R - Valve Element - Installation
Figure 401

R D. Prepare to Install Valve Element

R NOTE: During installation, O-ring seals must be lubricated
R in accordance with 20-23-11.

R (1) Remove the drain plug and fit a new O-ring seal.
R Do not refit the drain plug at this stage.

R (2) Fit a new O-ring seal to the valve element.

R (3) Remove the blank from the canister aperture.

R E. Install Valve Element

R (1) Comply with the electrical and fuel safety
R precautions.

R (2) Insert the valve element into the canister. Ensure
R that the valve body cut-outs are aligned with the
R clamp nuts, then push the valve element firmly and
R fully into the canister.

R (3) Rapidly rotate the valve element counter-clockwise
R through 90 deg.

R NOTE: Some fuel will drain when the element is
R rotated.

R (4) Torque-tighten the clamp nuts to between 45 and
R 55 lbf in (0.508 and 0.621 mdaN).

R (5) Fit the drain plug and torque-tighten to between
R 10 and 14 lbf in (0.113 and 0.158 mdaN).

R (6) Secure the bonding lead to the structure bracket with
R the washer and bolt. Torque-tighten the bolt to
R between 35 and 44 lbf in (0.395 and 0.497 mdaN).

R (7) Connect the electrical connector to the valve,
R ensuring that the mating surfaces are clean and
R undamaged.

R (8) Check that the bonding of the valve element
R installation is in accordance with 20-27-11.

R F. Conclusion

(1) Remove the safety clips and reset the circuit breakers
tripped previously.

R (2) Carry out an Operational Test and a Functional

Test of the valve (Ref. Adjustment/Test).

(3) Refit the access panel (Ref. Fig. 401) as detailed in 57-00-00, Removal/Installation.

(4) Remove the warning placard.

3. Valve Motor (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Remove the valve element (Ref. para.2.).

C. Remove Valve Motor

(1) Remove the self-locking nuts securing the motor to the studs on the valve body. Support the valve motor and disconnect the bonding lead.

(2) Remove the motor by disengaging the valve drive shaft from the motor coupling.

D. Prepare to Install Valve Motor

(1) Check that the mating surfaces of the valve and motor are clean and undamaged and that the splines on the drive shaft and motor coupling are free from damage.

E. Install Valve Motor

(1) Align the master spline of the motor drive shaft with the master spline of the motor coupling and insert the drive shaft into the coupling. Ensure that the locating dowel is correctly engaged.

(2) Attach the bonding lead to the appropriate stud and fit a self-locking nut to each stud. Torque-tighten each nut to between 28 and 32 lbf in (0.316 and 0.362 mdaN) in accordance with 20-21-11. Check that the bonding is in accordance with 20-27-11.

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F. Conclusion

(1) Install the valve element (Ref. para.2.).

4. Canister (Ref. Fig. 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

After SB 28-018 For A/C 001-005,

DESCRIPTION	PART NO.
Sealant tools for removal/application of sealants, (Ref. 28-11-00, Approved Repairs - Sealants)	-
Sealants	-
PR1720R (Ref. 20-30-00, No.390)	-
PR1720SM (Ref. 20-30-00, No.351)	-
Cyclohexanone, for use with sealant PR1720R	-
Cleaning Solvents	
Methylethylketone (MEK) (Ref. 20-30-00, No.470)	-
Methylisobutylketone (MIBK) (Ref. 20-30-00, No.483)	-
Halogenated hydrocarbon solvent R.113 (Ref. 20-30-00, No.484)	-
RB Eurotwill cloth	-

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B. Prepare to Remove Canister

(1) Ensure that all switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the setting of switches must not be altered.

(2) Defuel the tanks (Ref. 28-25-00) appropriate to the position of the canister.

(a) Canister in tank 7 - defuel tank 7.

(b) Canister in tank 6 - defuel tanks 5 and 6.

(3) Remove the valve (Ref. paras.2.B. and 2.C.).

(4) Remove the appropriate access panel, 625 EU or 525 EU (Ref. Fig. 402).

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C. Remove Canister

NOTE: In the following operation, the position of the special earthing bolt must be noted.

(1) Remove the canister securing bolts and washers and remove the canister support collar.

(2) Inside the tank, lift the locking clip and unscrew the joint nut of each interconnecting pipe-end. Support the canister.

(3) Remove the bolts securing the interconnecting pipe flanges to the canister. Note the position of the special bonding lead attachment bolts for subsequent installation.

Before SB 28-018

(4) Disengage the interconnecting pipes from the canister and remove the canister from its mounting on the interior wall of the tank. Remove and discard the O-ring seals at the canister mounting face and at the pipe ends.

After SB 28-018 For A/C 001-005,

WARNING: SOLVENTS 'MEK' AND 'MIBK' ARE BOTH FLAMMABLE AND TOXIC. R.113 IS TOXIC.

TAKE THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS WHEN USING CLEANING SOLVENTS.

(4) Remove the canister as follows:

(a) Disengage the interconnecting pipes from the canister.

(b) Using the sealant cutting tool and solvent, carefully separate the canister from the tank wall.

(c) Remove the canister and remove the O-ring seals from the pipe ends.

(d) Remove the seal from the canister and thoroughly clean off any remaining sealant.

D. Install Canister

CAUTION: ENSURE THAT THE BONDING LEADS ARE FREE FROM STRAIN DURING THE FOLLOWING PROCEDURES.

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals to the interconnecting pipe ends. Lubricate them in accordance with 20-23-11 before installation.

(3) Ensure that the single clamp-nut of the canister is uppermost, then insert the pipe-ends into their respective ports. Locate the flanged end fitting of each pipe against the face of the port.

(4) Fit the flange securing bolts and washers. Secure the bonding leads with the special bolts at the positions noted during removal. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN), then check that the bonding is in accordance with 20-27-11.

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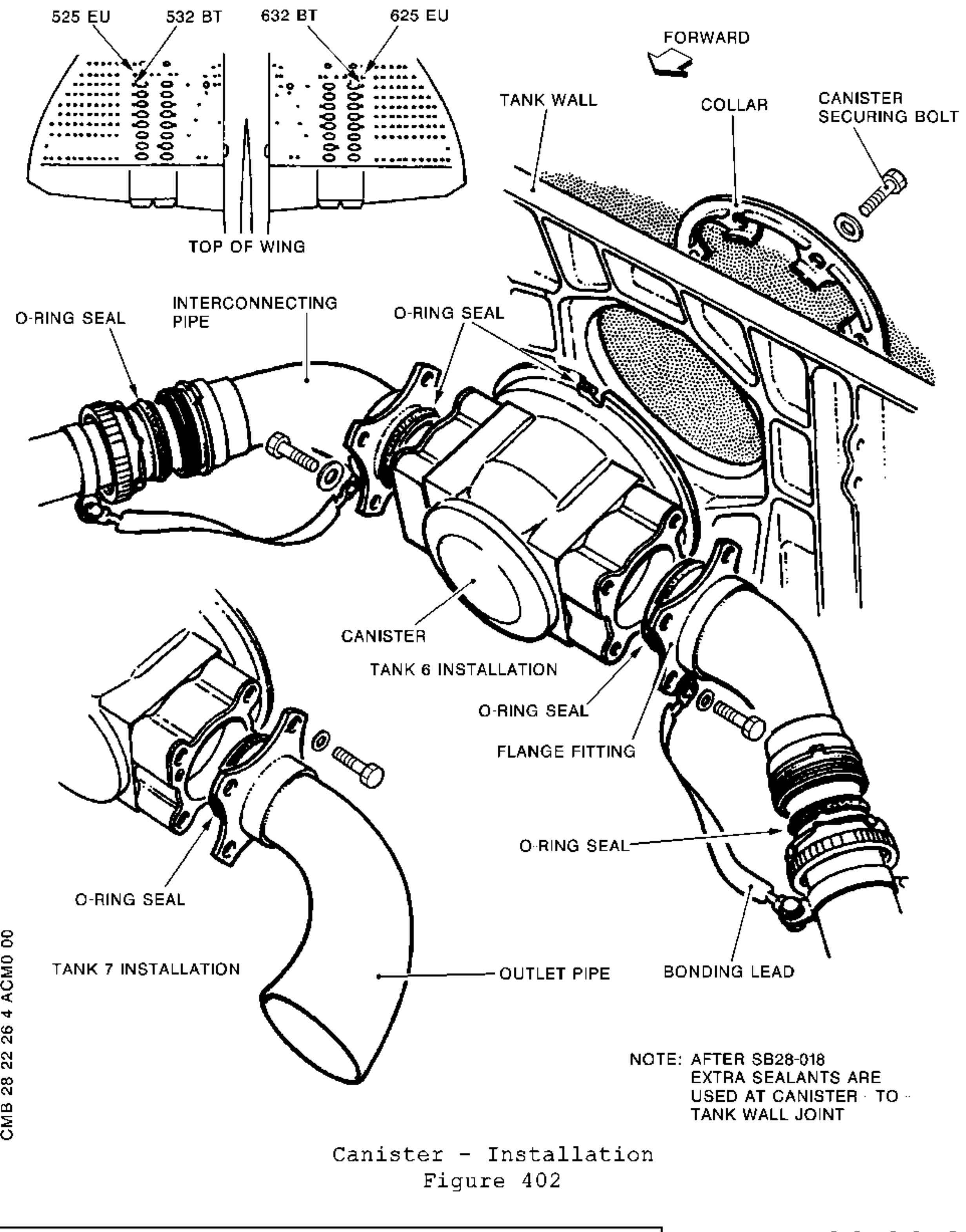

Canister - Installation
Figure 402

Before SB 28-018

(5) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the canister mounting face and locate the canister on its mounting on the tank wall. Ensure that the pipe-ends are correctly mated with the system pipes.

After SB 28-018 For A/C 001-005,

(5) Apply sealants as follows:

(a) Fit a new, dry O-ring seal to the groove in the canister.

(b) Apply sealant PR1720R (prefabricated tape) or PR1720SM (semi-paste/fluid) to the mating face of the canister in accordance with 20-22-21.

(c) Position the canister on its mounting on the tank wall. Ensure that the pipe ends are correctly mated with the system pipes.

(6) Position the support collar, then secure it and the canister with the bolts and washers. Ensure that the special earthing bolt is in its correct position, as noted during removal, and torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(7) At each interconnecting pipe-end, tighten the joint nut by hand until the nut abuts the elbow flange and the locking clip engages the tongue, as detailed in 20-23-21.

E. Conclusion

(1) Install the valve element (Ref. para.2.D.).

(2) Carry out a Leakage Test of the canister and pipe connections (Ref. 28-22-26, Adjustment/Test).

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

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R (4) Refit tank access panel.

R (5) Carry out an Operational Test and a Functional Test of the valve (Ref. Adjustment/Test).

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TRANSFER SHUT-OFF VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The transfer shut-off valves regulate the transfer of fuel between tanks 5A and 5 and between tanks 7A and 7. Each valve has a control switch which, with an indicator, is located on the fuel management panel. When transferring fuel from tanks 5A and 7A, with valve switches and pump switches set to ON, the valves are controlled automatically through high level sensors in the receiving tank.

This topic includes an Operational and a Functional Test of the valve and a leakage test of the canister.

2. Transfer Shut-off Valve - Operational Test

A. Prepare

(1) Ensure that all fuel control switches on the fuel management panel are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that tank 5 or 7, as appropriate, is full.

NOTE: This is to ensure control of the shut-off valve via the associated high level sensor and transfer pumps switch.

(4) Ensure that tank 5A (or 7A) contains at least 1,000 kg of fuel.

B. Test

(1) With the TRANS VALVE 5A-5 (or 7A-7) switch at SHUT, check that the magnetic indicator displays bar-across-line.

(2) Set the TRANS VALVE 5A-5 (or 7A-7) switch to "OPEN". Check that the magnetic indicator display changes to diagonal stripes and then to bar-in-line within 2 s.

(3) Set either LH or RH PUMPS switch for tank 5A (or 7A)

to "ON". Check that the TRANS VALVE 5A-5 (or 7A-7) magnetic indicator display changes from bar-in-line to diagonal stripes and then to bar-across-line within 2 s.

(4) Set either LH or RH PUMPS switch for tank 5A (or 7A) to "OFF". Check that the TRANS VALVE 5A-5 (or 7A-7) magnetic indicator display changes from bar-across-line to diagonal stripes and then to bar-in-line within 2 s.

(5) Set the TRANS VALVE 5A-5 (or 7A-7) switch to "SHUT". Check that the magnetic indicator display changes from bar-in-line to diagonal stripes and then to bar-across-line within 2 s.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Transfer Shut-off Valve - Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Key, access panel	E920132000

B. Prepare

(1) Check that all fuel control switches on the fuel management panel are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that the appropriate transferring tank is full and that the receiving tank is not filled to more than 80 per cent capacity.

(4) Remove the appropriate access panel, 532 BT and AT or 632 BT and AT, using the key on the AT panel.

C. Test

(1) On the fuel management panel, set one of the two

pump switches for the appropriate tank to "ON".

(2) Set the TRANS VALVE 5-5A or 7-7A switch, as appropriate, to "OPEN". Observe that the appropriate indicator displays bar-in-line and that, viewed through the access panel removed in operation B.(4), the OPEN 'pop-out' visual indicator plunger is extended.

(3) Observe the transfer tank contents indicator and check that, for a minimum duration of 3 min, the
R transfer rate of fuel is not less than 73 kg/min
R (between tanks 5A and 5) (or 81 kg/min between tanks 7A and 7).

(4) Continue to transfer fuel until the receiving tank reaches high level and the transfer shut-off valve closes automatically. Check that the SHUT 'pop-out' visual indicator plunger is extended. During this check, ensure that there are no signs of any fuel leaks at the shut-off valve.

(5) Set the pump switch to "OFF". Check that the transfer shut-off valve opens.

NOTE: The valve will open because of the inhibition of the high level sensing circuit resulting from the pump being switched to OFF.

(6) Set the TRANS VALVE 5A-5 (or 7A-7) switch to "SHUT". Check that the magnetic indicator display changes from bar-in-line to diagonal stripes and then to bar-across-line.

D. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Refit the access panel, 532 BT and AT, or 632 BT and AT, ensuring that the mating surfaces are clean and undamaged. Torque-tighten the screws for the BT panel to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

4. Canister - Tank 5A-5 - Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable container, up to 2 pints (1 l) capacity	-
Key, access panel	E920132000

B. Prepare

(1) Refuel tank 5A to full capacity (Ref. 12-11-28).

(2) Defuel tanks 6 and 5 (Ref. 28-25-00, Servicing).

(3) Drain residual fuel from tank 6 and remove access panel 525 AB. Prepare tank 6 for entry (Ref. 28-10-00, Servicing).

(4) Remove the access panel 532 AT.

C. Test

(1) Set tank 5A PUMPS switches to "ON"; check that the associated LOW PRESS caption is extinguished.

(2) Set the TRANS VALVE 5-5A switch to "OPEN"; check that the associated indicator displays bar-in-line.

(3) Check, for a 5 min period, that there are no fuel leaks from -

(a) the element-to-canister joint face, and

(b) the transfer pipes-to-canister joints.

(4) Set the tank 5A PUMPS switches to "OFF".

(5) Set the TRANS VALVE 5-5A switch to "SHUT".

(6) Remove the valve element (Ref. Removal/ Installation).

(7) Check that the leak rate through the canister isolating sleeve is not more than 7.6 cc/min.

(8) Refit the valve element to the canister (Ref. Removal/Installation).

D. Conclusion

(1) Refit the access panel, 525 AB, ensuring that the mating surfaces are clean and undamaged.

(2) Refuel the tanks 5 and 6 (Ref. 12-11-28). Check that there are no fuel leaks from the tank access panel and the canister-to-tank mounting.

(3) Refit the access panel 532 AT.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. Canister - Tank 7A-7 - Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable container, up to 2 pints (1 l) capacity	-
Key, access panel	E920132000

B. Prepare

(1) With the tank 7A-7 transfer valve shut, refuel tank 7A to full capacity (Ref. 12-11-28).

(2) Defuel and drain tank 7 (Ref. 28-25-00, Servicing).

(3) Remove the access panel 626 BB and prepare the tank for entry (Ref. 28-10-00, Servicing).

(4) Remove the access panel 632 AT.

C. Test

(1) Set the tank 7A PUMPS switches to "ON". Check that the associated LOW PRESS caption is extinguished.

(2) Check, for a 5 min period, that there are no fuel leaks from -

(a) the element-to-canister joint face, and

R (b) the transfer pipe-to-canister joint.

R (3) Set the tank 7A PUMPS switches to "OFF".

R (4) Remove the valve element (Ref. Removal/
R Installation).

R (5) Check that the leak rate through the canister
R isolating sleeve is not more than 7.6 cc/min.

R (6) Refit the valve element to the canister (Ref.
R Removal/Installation).

R D. Conclusion

R (1) Refit the access panel 626 BB, ensuring
R that the mating surfaces are clean and undamaged.

R (2) Refuel the tank 7 (Ref. 12-11-28). Check that
R there are no fuel leaks from the tank access
R panel and the canister-to-tank mounting.

R (3) Refit the access panel 632 AT.

R (4) Switch off and disconnect electrical ground power
R as detailed in 24-41-00.

**ON A/C 001-005,

TRIM TRANSFER SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

**ON A/C 001-005,

(Ref. Fig. 002)

R B WARNING: FUEL TRIM TRANSFER INLET VALVES SHOULD REMAIN
R B SHUT AT ALL TIMES, EXCEPT WHEN BEING OPERATED
R B FOR A SPECIFIC MAINTENANCE TASK. ENSURE
R B VALVES ARE SHUT BEFORE VACATING FLIGHT DECK.

R B NOSE GEAR SHOCK ABSORBER EXTENSION IS A GOOD
R B INDICATION OF AIRCRAFT OVERBALANCE AND SHOULD
R B NEVER EXCEED 23.5 INS (596 mm).

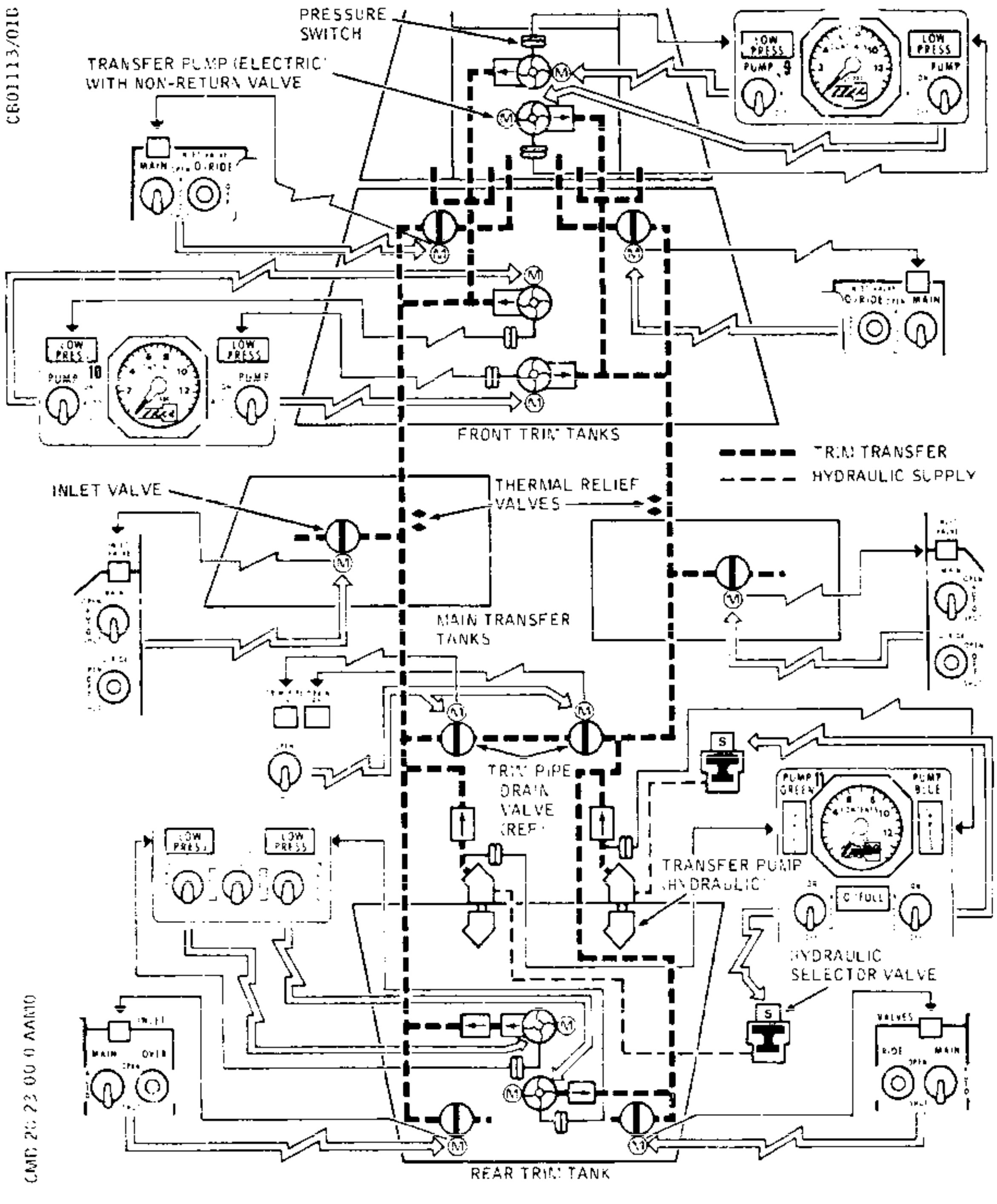
**ON A/C 001-005,

The trim transfer system transfers fuel between the front and rear trim tanks, to move the aircraft centre of gravity in accordance with aerodynamic centre of pressure movement during take-off and transonic acceleration and deceleration.

At the start of supersonic cruise the required rearward movement of the centre of gravity is obtained by transferring fuel from the front tanks (9 and 10) to the rear tank (11). Conversely, at the end of supersonic cruise, the required forward movement is obtained by transferring fuel from tank 11 to tank 9. Fuel in excess of trim tank requirements is transferred to the main transfer tanks 5 and 7 from where it is made available to the engines via the collector tanks.

Fuel is conveyed between the front and rear trim tanks by two completely separate trim transfer pipes, one in each side of the aircraft, extending through the main tanks, and the rear fuselage. As a means of relieving fuel pressure, when all inlet valves are closed and a temperature change occurs either in flight or on the ground, thermal relief valves are installed in each trim transfer pipe. The left-hand pipe connects with main transfer tank 5 and the right-hand pipe with main transfer tank 7. Electric motor-driven inlet valves control the flow of fuel from the trim pipes to all trim tanks and main transfer tanks 5 and 7. Additional control valves and components connected to the trim transfer pipes enable them to be adapted for refuel, defuel, and dump operations (Ref. 28-24-00, 28-25-00 and 28-31-00).

Fuel from the front trim tanks is pumped rearward by four



CB01113/01C

CMD 28 23 00 0 AAM0

Trim Transfer - Schematic
Figure 001

EFFECTIVITY: 001-005,

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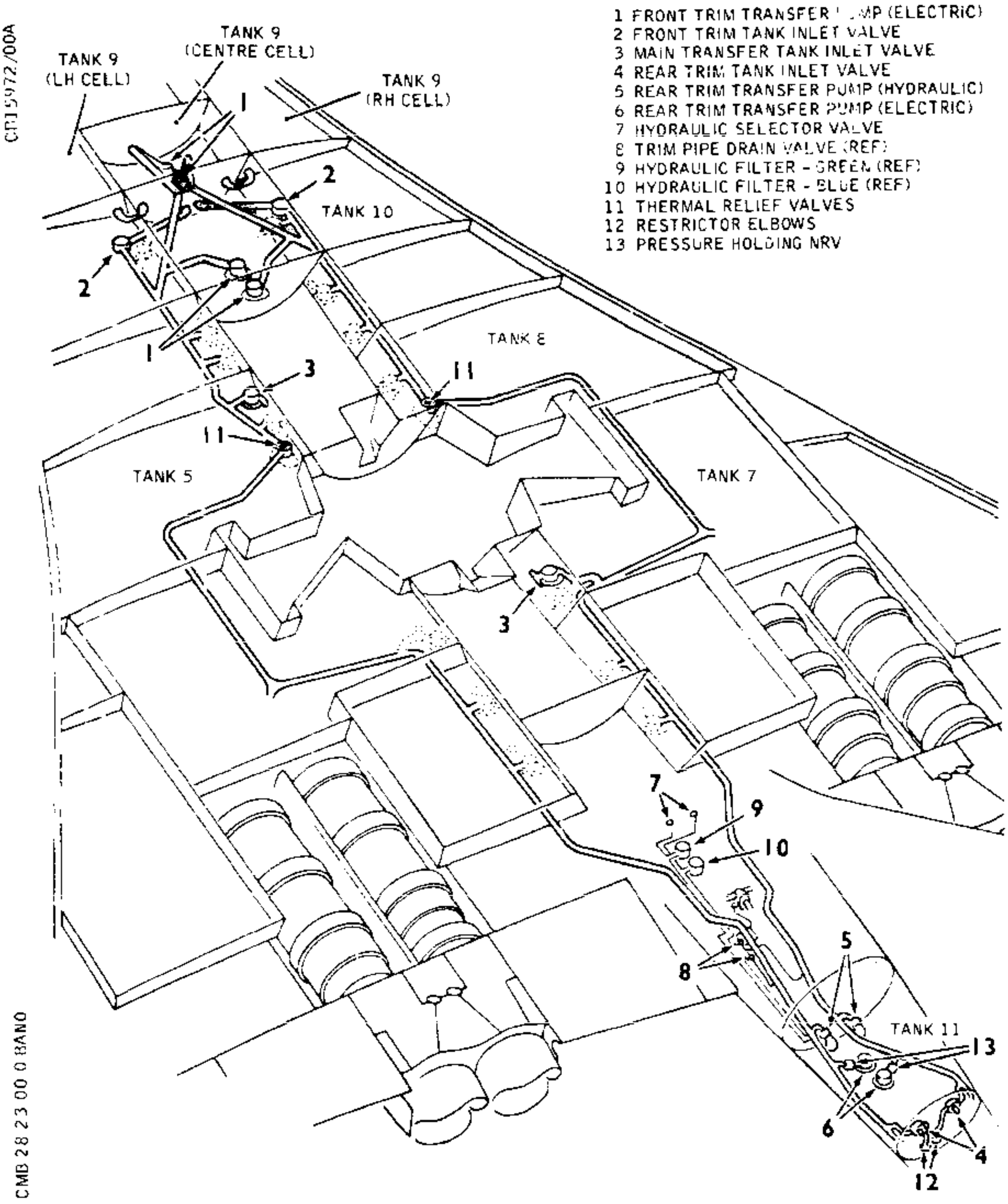


- Trim Transfer System - Component Location
Figure 002

electric motor-driven pumps mounted in the tanks. These are controlled by separate switches and fed from independent circuits arranged to obviate the total loss of pumping capacity in the event of partial electrical power failure.

After SB 28-048 For A/C 001-005,

The starting of the front trim tanks pumps is electronically controlled.

**ON A/C 001-005,

Restrictors are built into tank 11 inlet elbows to achieve the optimum fuel system management procedure for rearward trim transfer.

**ON A/C 001-005,

For forward trim transfer, rear trim tank 11 contains four pumps, two hydraulically driven and two electrically driven. Normal forward transfer is by the two hydraulic pumps, the electric pumps being standby pumps.

All the pumps, both electric and hydraulic, are installed in isolation canisters to facilitate removal without defuelling. A pressure switch, connected to each pump outlet, gives a low fuel pressure warning. Restrictor unions are used in the pressure switch supplies to limit the amount of fuel leakage if the supply pipe becomes fractured. The pump control switches and indicators are situated on the fuel system management panel at the third crew member's station.

Transfer of fuel is automatically controlled by the load limit section of the fuel quantity indication system (Ref. 28-44-00). The specific amounts of fuel required in the trim tanks are preselected on the load limit selectors on the fuel management panel.

Each tank inlet valve has two motors powered by separate electrical supplies. One motor is controlled either manually or automatically and the other, which is connected to an emergency power source, is controlled manually and overrides any signals previously given automatically.

The controls and indicators for the trim transfer system are laid out in a fuel flow form on the fuel system management panel. An automatic transfer selection activated at this panel can be overridden by an emergency forward transfer switch located on the pilot's roof panel.

2. Trim Transfer Pump - Electrically Driven (Ref. Fig. 003)

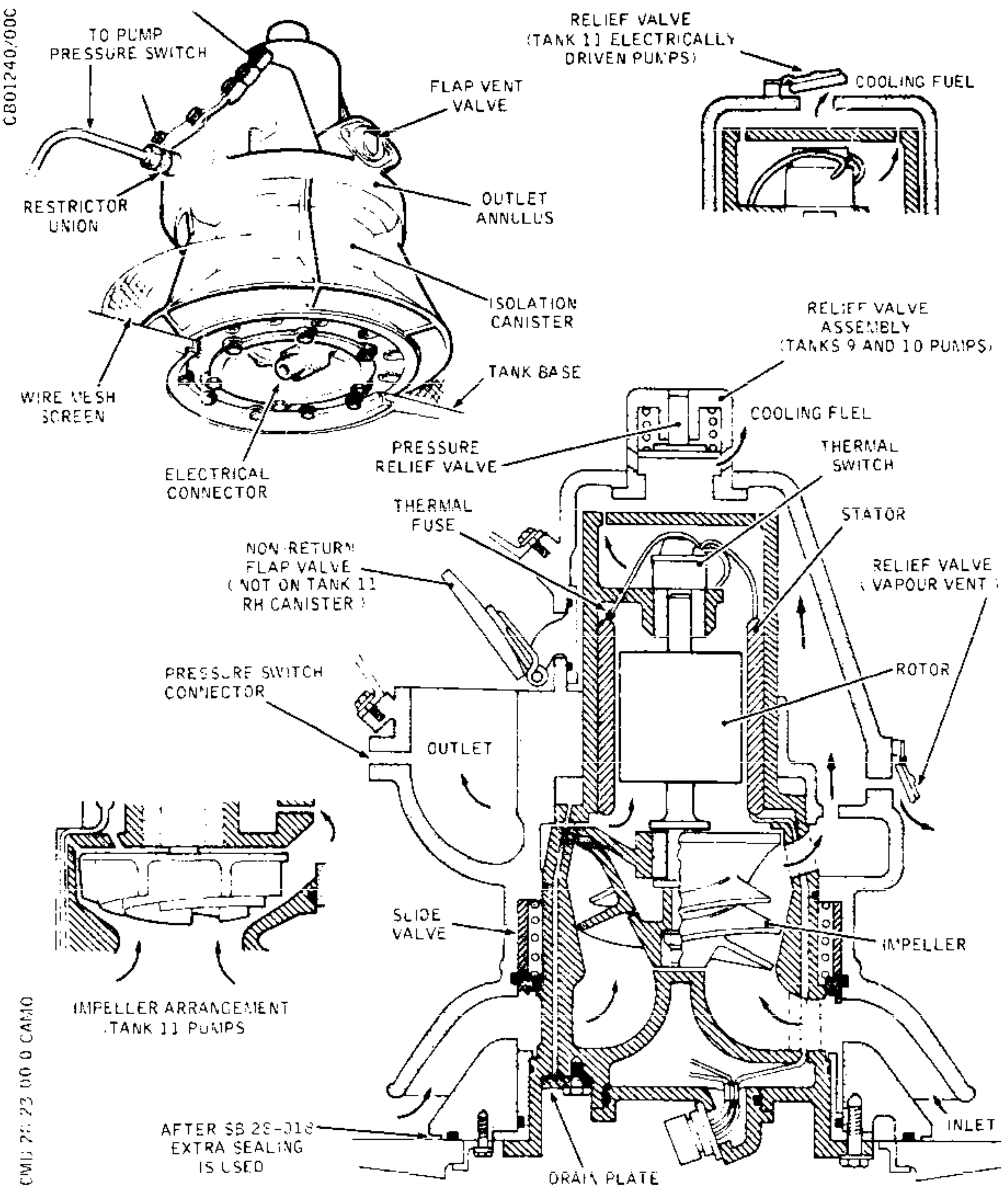
The six electrically driven pumps, two in each of tanks 9, 10 and 11, are basically similar. Each comprises an electric motor-driven, low pressure, centrifugal pump element, mounted in an isolation canister bolted to the tank floor. The motors use 200 V, three-phase, a.c. power and are independently controlled by switches on the fuel management panel.

The pump element comprises an inlet housing, a bearing housing and a stator housing bolted together to house a motor and a shaft-mounted impeller. The pump is completely flooded with fuel for cooling the motor and lubricating the bearings.

The motor, which comprises a rotor and a wound stator, is a three-phase, star-connected, squirrel cage induction motor. The star connection is made through a thermal switch mounted in the stator housing and connected to an electrical connector which is mounted on a lead wire cover. Thermal fuses are incorporated in the stator windings. Split carbon bearings mounted in sleeves in the castings support the rotor shaft. Pins, slot-located in the castings, prevent bearing rotation and a strip-spring loads the bearing against the shaft to compensate for wear and expansion. If the temperature of the motor rises to between 154 and 166 deg C (309 and 330 deg F) the thermal switch contacts open to interrupt the supply to the stator windings. When the temperature of the motor has fallen to between 120 and 132 deg C (248 and 269 deg F) the thermal switch contacts close to reinstate the supply to the stator windings. The thermal fuses rupture at 202 deg C (395 deg F).

Each pump has a spring-loaded non-return valve in its outlet that acts as a pressure maintaining valve and prevents reverse flow when the pump is inoperative. For each tank 9 and 10 pump and each tank 11 hydraulic pump, the valve is installed in the pump isolation canister outlet. For each tank 11 electric pump the valve is mounted in-line in the trim transfer pipe. In addition, the tank 11 LH electric pump has a spring-loaded flap non-return valve in the isolation canister outlet to prevent reverse flow from the de-aeration system when the pump element is removed. The pump inlets are protected against the ingress of any foreign matter and water by filter screens and dams.

The isolation canisters for all the electric pumps comprise a cast aluminium-alloy canister assembly machined to accommodate the pump element, a spring-loaded slide valve, a vapour vent valve, a relief valve and inlet and outlet ports. The slide valve, which is located in the inlet port, is retained by the valve seat and valve rotation is prevented by a tongue in the valve which engages in a slot in the seat.



- Trim Transfer Pump - Electrically Driven
Figure 003

A pin, pressed into the side of the canister, locates the pump element and prevents complete withdrawal of the element during the initial stage of element removal.

3. Pressure-holding Non-return Valve (Ref. Fig. 004)

The valve is mounted in-line with each tank 11 electric pump outlet and the trim transfer pipe.

The valve comprises an inlet and outlet body secured together with a trapwire to form a housing. To provide flexibility, a flange with a hemispherical inner surface fits over a hemispherical surface of the outlet body. The flange, complete with O-ring seals and backing ring, is assembled to the outlet body during installation.

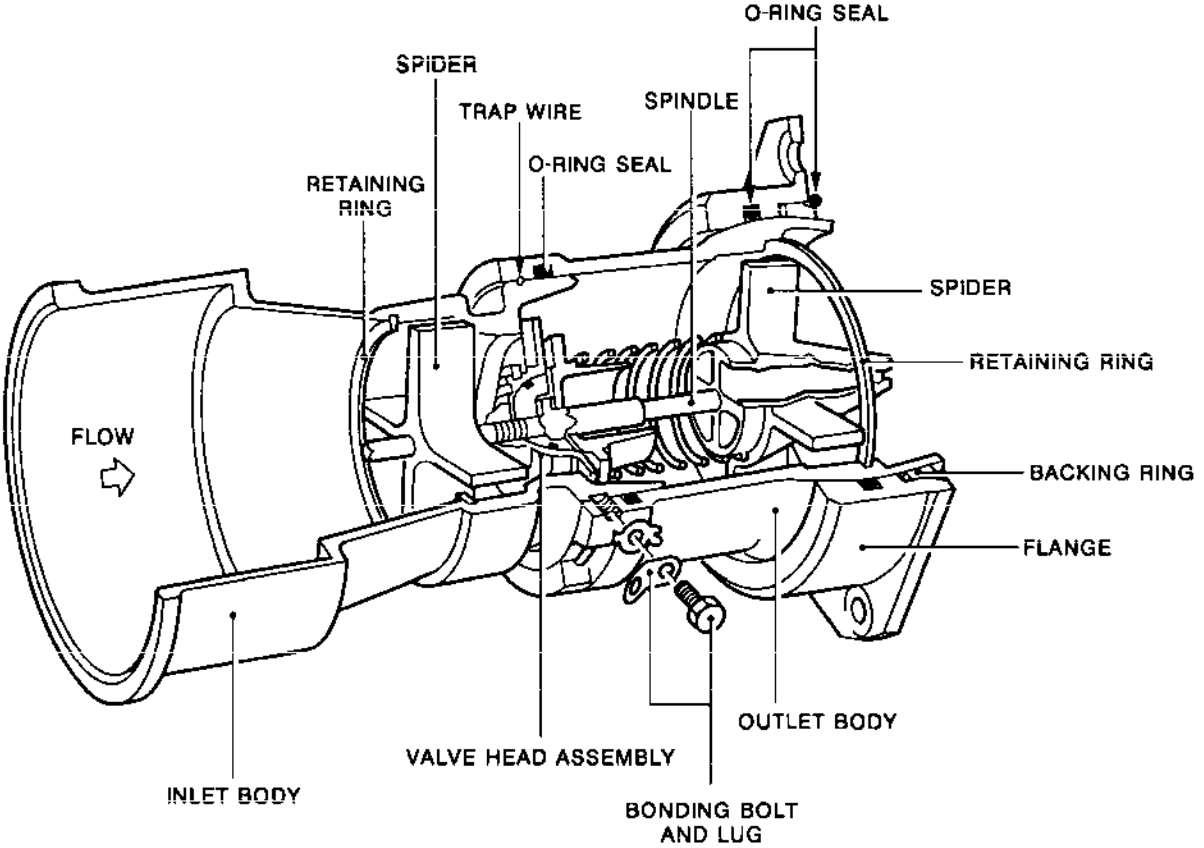
The housing supports two spiders with a spindle. The spindle has a valve head assembly secured to it. The valve head assembly is spring-loaded against the inner face of the inlet body. Fuel pressure above 1.75 psig (0.1208 bar) at the inlet will overcome the spring loading and lift the valve head off its seating.

4. Trim Transfer Pump - Hydraulically Driven (Ref. Fig. 005)

Two identical (left and right), hydraulic motor-driven pumps are fitted in tank 11 and deliver fuel into the left and right trim transfer pipes. Each pump element is mounted in an isolation canister which is bolted to the outside of the tank forward wall, with the canister inlet port duct projecting through the wall into the tank. The pumps can also be used to jettison fuel overboard. The left and right pumps are powered by the GREEN and BLUE hydraulic systems respectively (Ref. 29-00-00). Pressure is directed to each pump by a solenoid-operated selector valve mounted on each hydraulic system distribution manifold. The valves are independently controlled by switches on the fuel management panel.

The pump element consists of a hydraulic motor, driving a main pump impeller and a priming pump rotor, both mounted on a single shaft, lubricated by fuel. A flexible pipe from the rear bearing housing enables any fuel entering the housing to drain overboard via a vent in the aircraft skin. Fuel is drawn into the pump body through a large single inlet port concentric with the driving shaft and discharged into an outlet annulus in the isolation canister.

The priming pump prevents an air lock occurring at the impeller if the impeller becomes uncovered by fuel. The pump draws air and fuel through a drilling in the centre of the



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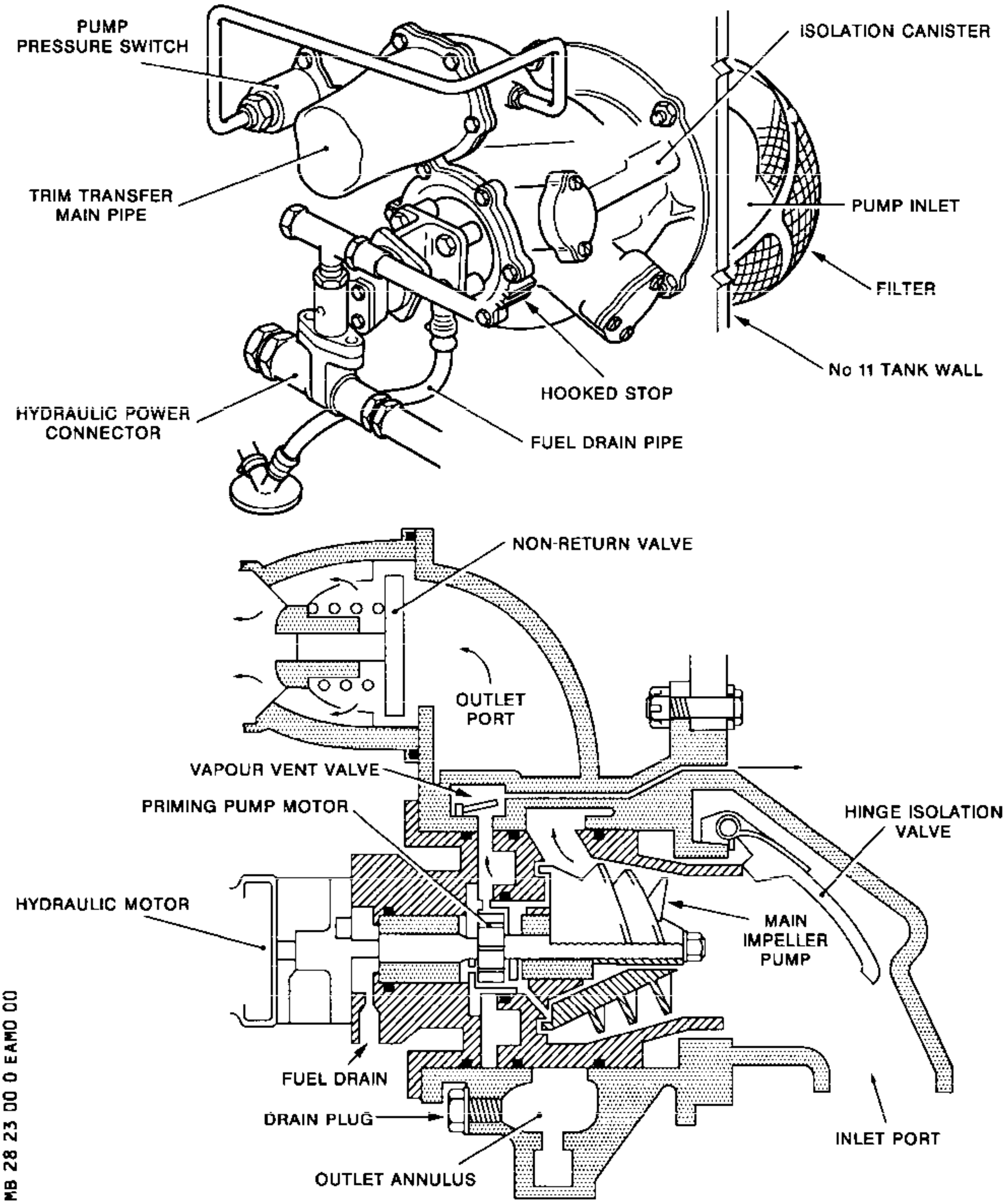
Pressure-holding Non-return Valve
Figure 004



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Trim Transfer Pump - Hydraulically Driven
Figure 005

impeller and discharges it through a vent valve in the canister casing, back into the fuel tank. The vent valve is closed by a spring to isolate the fuel in the tank when the pump is removed.

Two external fuel ducts are integral with the isolation canister casing. One, from inside the tank, leads to the pump inlet port and the other stems from the canister outlet annulus and connects with the trim transfer pipe system. With the pump element installed, a lug at its inlet port projects into the canister inlet port to hold open a hinged isolation flap valve.

A hooked stop on the pump casing prevents complete withdrawal of the pump during its initial stage of removal, thus enabling any fuel trapped in the pump to be drained off before separating the pump from the isolation canister.

Removal of the pump element causes the flap valve to close under spring pressure to isolate the canister inlet port from the fuel in the tank. The canister outlet port contains a spring-loaded, non-return poppet valve, which prevents gravity flow of fuel out of the tank when the pump is inoperative, but prevents a reverse flow to the tank.

5. Hydraulic Fuel Transfer Pump Drive Motor (Ref. Fig. 006)

A drive motor is bolted to each pump mounted on the forward bulkhead at tank 11.

The hydraulic fuel transfer pump drive motor is a fixed stroke, axial piston type having a constant displacement. Its flow and speed are maintained constant by an integral flow control valve located at the inlet side of the motor. It is used in conjunction with the aircraft hydraulic system to translate hydraulic power into rotary motion to drive a fuel transfer pump.

Fluid from the aircraft hydraulic system is fed, via the inlet port and flow control valve, through a kidney-shaped slot in the valve block and wafer plate into piston bores in the cylinder block. The pistons move away from the valve block when under pressure, causing rotation of the drive shaft due to the angle of displacement, and so driving the fuel pump.

When the pistons reach the lowest point of travel down the inlet side they will begin to rise on the outlet side, transferring fluid through a second kidney-shaped slot in the wafer plate and valve block to the outlet port. This fluid is forced at low pressure back to the hydraulic reservoir, thus completing the cycle.

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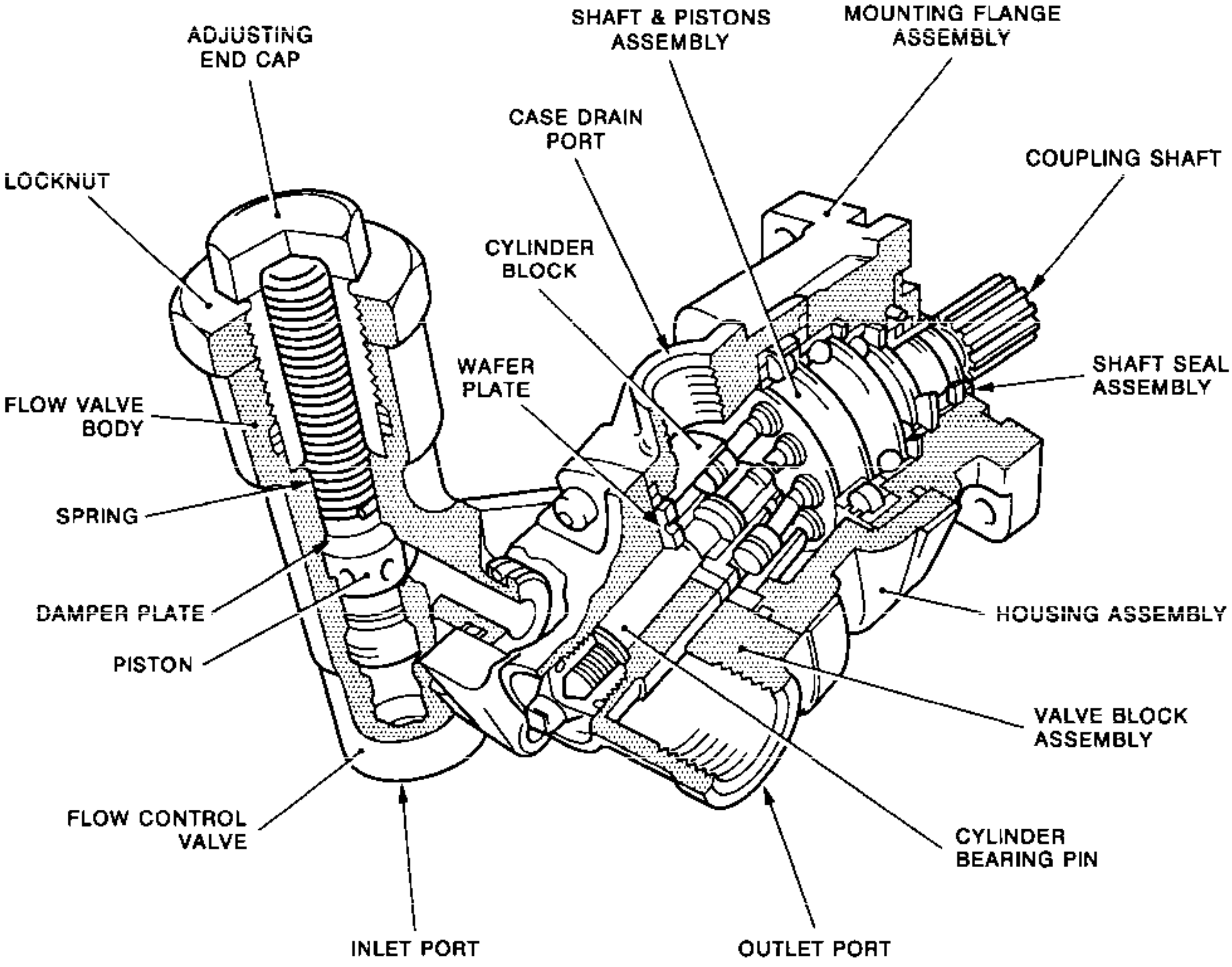

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Hydraulic Fuel Transfer Pump Drive Motor
Figure 006

Fluid flowing through the inlet port above a predetermined value causes the flow valve piston to move against the force of the spring. Outlet holes in the piston leading to the valve block inlet port become partially covered, reducing the flow as necessary to maintain a constant flow and speed to the motor.

6. Hydraulic Selector Valve (Ref. Fig. 007)

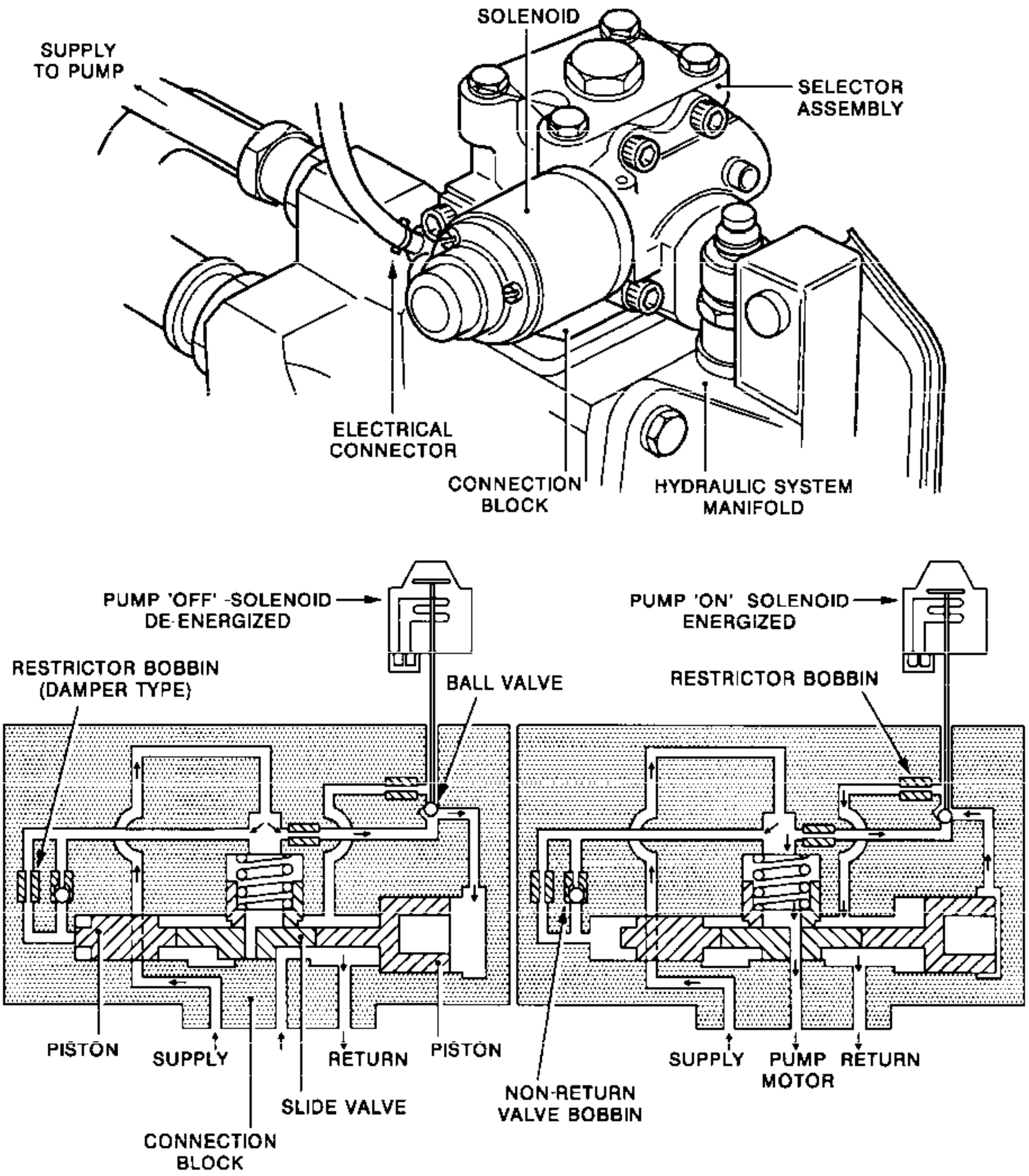
Electrically operated valves control each rear transfer hydraulic pump. Each valve is mounted on the manifold of the hydraulic system which supplies the associated pump motor; independent control switches are located on the fuel management panel.

The base of the unit forms a hydraulic connection block with the manifold. Contained in the unit body is a spring-loaded slide valve operating across the service port in the connection block. The slide valve is moved by two opposing pistons of different diameters. Pressure supply to the larger piston is controlled by a ball valve contained within pressure and return seats in the fluid ducts. A solenoid - operated spindle is located through the return seat and held away from the ball by a spring. Pressure supply to the smaller piston is direct and constant.

With the pump control switch set to OFF, the solenoid is de-energized and the spindle held out, permitting fluid pressure to force the ball against the return seat and allow flow to the larger piston. The difference in surface areas of the pistons allows a greater force to be applied on the larger piston, resulting in the piston being held at the limit of its travel. In this condition the slide valve is positioned so that it blanks off the service port to the pump motor, but allows fluid entering the unit to return to the manifold.

When the pump control switch is set to ON, the solenoid is energized, causing the spindle to push the ball against the pressure seat. With the pressure supply cut off from the larger piston, the pressure on the smaller piston moves the port in the slide valve in line with the service port in the connection block, allowing fluid to pass to the pump motor. Fluid displaced by the larger piston to the manifold returns through the open return seat of the ball valve.

R The restrictor bobbin (damper type) and another restrictor
R bobbin are fitted to slow down the slide movement when the
R solenoid is energized. This prevents the rapid opening of
R the main supply to the pump motor during selection. The
R non-return valve bobbin allows free flow out of the small



Hydraulic Selector Valve
Figure 007

R

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CMB 28 23 00 0 GAM0 00

R piston chamber during selection, when the solenoid is de-
R energized, to prevent over-pressurization.

7. Inlet Valve

The six inlet valve units are identical, each comprising a valve element mounted in an isolation canister. Each element consists of two separately controlled electric motors (one a standby), driving through a differential epicylic gear train, and a spherical plug valve. The description of the valve unit components is the same as that given for the LP isolation valve (Ref. 28-21-00).

Two of the inlet valves are installed in the trim pipe to control the flow of fuel into tank 9. The valve canisters are mounted on the floor of tank 10 left and right cells. The two inlet valves for tank 11 are installed in the left and right trim transfer pipes in the rear fuselage on frame 88, their canisters being mounted on the fuselage structure. Two inlet valves, one for each of tanks 5 and 7, are installed near the outlet end of the trim transfer pipe in the respective tanks. The valve canisters are mounted on the floor of each tank.

8. Pump Pressure Switch

Warning of low pressure output from each transfer pump is given by a caption light on the system management panel operated by a fuel pressure switch. The switches for the forward trim pumps are mounted in the forward underwing fairing. Those for the rear transfer pumps are attached to the outside wall near the pumps (Ref. Fig. 005).

The description of the pressure switch components is the same as that given for the de-aeration pump pressure switch (Ref. 28-13-00).

After SB 28-048 For A/C 001-005,

9. Pump Start Control Unit (Ref. Fig. 008)

The pump start control unit comprises a metal case that houses the electronic pulse start control circuits. The front panel of the unit houses the electrical connector and built-in test equipment (BITE) indicators. The indicators comprise three neon lamps, identified A, B and C, and two light-emitting diodes (LEDs), identified 5 and 6.

The unit is used to prevent transient high fuel pressure in

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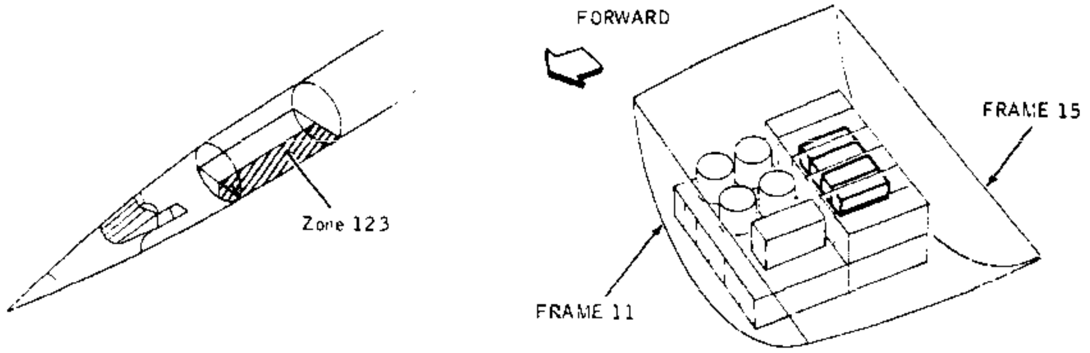

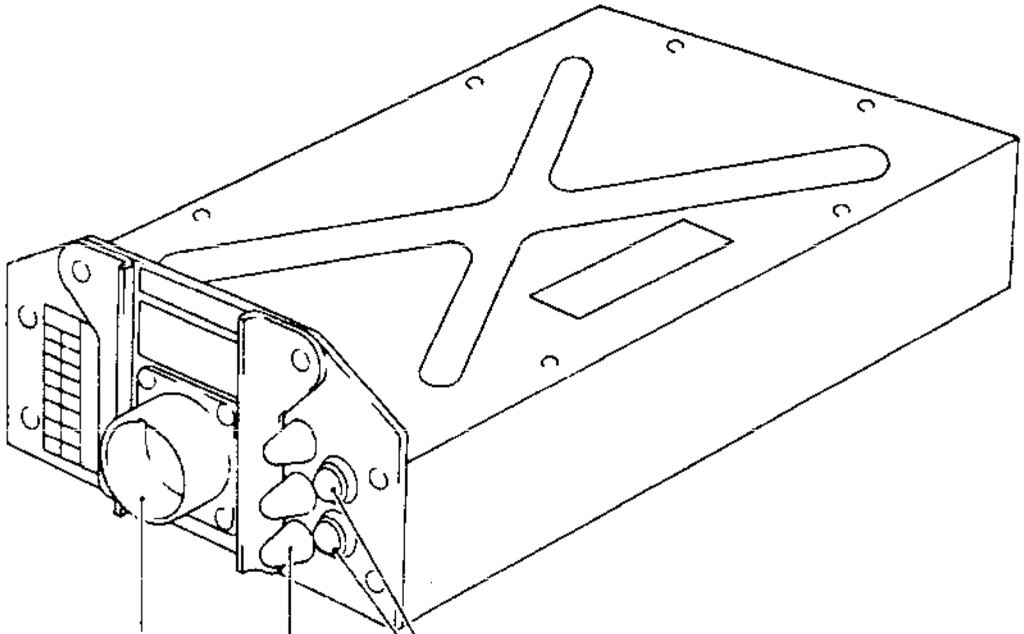

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Pump Start Control Unit
Figure 008

the main trim transfer pipe, by controlling the average acceleration during starting of the trim pumps in tanks 9 and 10. The unit inhibits the pump contactor operation and controls the three-phase supply to linearly extend the pump starting period to approximately 5 s. After 5 s the unit causes the pump contactor to be energized and then terminates the starting cycle; the pump contactor then controls the running period of the pump.

The control units are attached to the rear of the top right aft panel in the forward underfloor racking in zone 123. The units are each secured by two screws and a spigot.

10. Operation

A. Control and Indication (Ref. Fig. 009)

The control switches and indicators for the trim transfer system are located in flow form at the centre of the fuel management panel at the third crew member's station.

Each trim transfer pump is independently controlled by a PUMP (ON - AUTO - OFF) switch. An associated yellow LOW PRESS caption is illuminated to give warning of low fuel pressure delivery by pump. The caption has a dimming facility.

Each trim transfer inlet valve can be driven either by its normal or its standby motor. The normal motor is controlled either manually or automatically by a MAIN (OPEN - AUTO - SHUT) switch, provided that the associated standby motor O/RIDE (OPEN - OFF - SHUT) switch is set to OFF. This O/RIDE switch is locked in the OFF position and must be pulled out against spring tension before either OPEN or SHUT can be selected. Each valve has a three-position magnetic indicator which shows 'in-line' and 'cross-line' with the fuel flow line on the panel when the valve is open and shut respectively, and diagonal stripes either with the circuit de-energized or when the valve is in transit.

Certain refuelling valves, for tanks 1, 2, 3, 4, 5, 6, 7, 8 and 10 (Ref. 28-24-00), can also be used for in-flight trim transfer. These valves are controlled by STANDBY INLET VALVE switches which have OPEN and SHUT positions and are located on the fuel management panel. The switches are locked in both OPEN and SHUT positions and must be pulled out against spring tension before operation. Magnetic indicators are provided for tank valves 1, 2, 3, 4 and 10 only as these are the valves used for special trim operations. Each magnetic indicator shows OPEN or SHUT,

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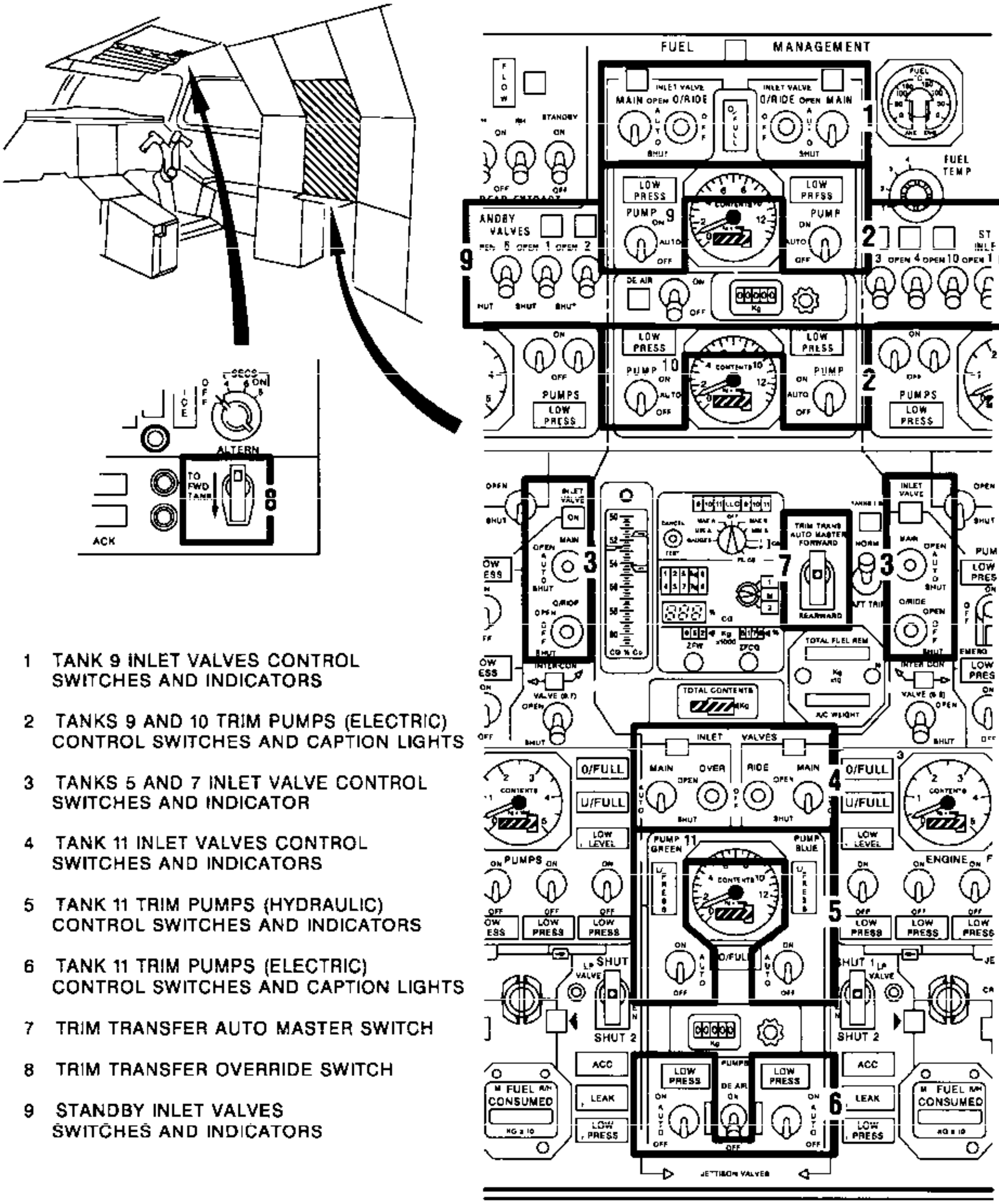

1 TANK 9 INLET VALVES CONTROL SWITCHES AND INDICATORS

2 TANKS 9 AND 10 TRIM PUMPS (ELECTRIC) CONTROL SWITCHES AND CAPTION LIGHTS

3 TANKS 5 AND 7 INLET VALVE CONTROL SWITCHES AND INDICATOR

4 TANK 11 INLET VALVES CONTROL SWITCHES AND INDICATORS

5 TANK 11 TRIM PUMPS (HYDRAULIC) CONTROL SWITCHES AND INDICATORS

6 TANK 11 TRIM PUMPS (ELECTRIC) CONTROL SWITCHES AND CAPTION LIGHTS

7 TRIM TRANSFER AUTO MASTER SWITCH

8 TRIM TRANSFER OVERRIDE SWITCH

9 STANDBY INLET VALVES SWITCHES AND INDICATORS

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Trim Transfer Controls and Indicators
Figure 009

according to the valve position, and diagonal stripes when the valve is in transit or the circuit is de-energized.

The TRIM TRANS AUTO MASTER switch is the guarded toggle type with FORWARD - OFF - REARWARD positions.

The FUEL FWD TRANS override switch is located on the pilots' roof panel and has two positions, one normal the other O/RIDE. The normal position permits the use of the auto master switch to initiate auto transfer through the auto trim relays, provided all appropriate switches are set for auto transfer. In similar circumstances when O/RIDE is selected the auto master switch and the load limit control and standby c.g. pack are bypassed and forward transfer is initiated through the override relay.

Caption filaments can be checked by depressing the LIGHT TEST push-switch, on the electrical services panel.

B. Functional Description (Ref. Fig. 010)

Normally automatic, trim transfer operations are initiated by the master control. The amount of fuel transferred is controlled by the load limit control section of the fuel quantity indication system (Ref. 28-44-00). In an emergency, any selection of the master control or load limit selection can be overridden and forward transfer initiated by setting the FUEL FWD TRANS override switch to O/RIDE.

The start of cruise transfer consists of transferring all the fuel out of the forward tanks 9 and 10, filling rear tank 11 to a predetermined quantity and putting the remaining fuel into main tanks 5 and 7.

The end of cruise transfer consists of transferring all the fuel out of rear tank 11, putting a predetermined quantity into forward tank 9 and the remaining fuel into main tanks 5 and 7. The fuel in tank 9 is part of the reserve fuel and may be transferred to the main tanks if required.

In the event of an emergency deceleration, fuel is transferred from tank 11 to tank 9. This transfer is always sufficient to move the c.g. and trim the aircraft for subsonic speeds.

The whole or any part of the transfer operation can be carried out either by preset automatic or by manual

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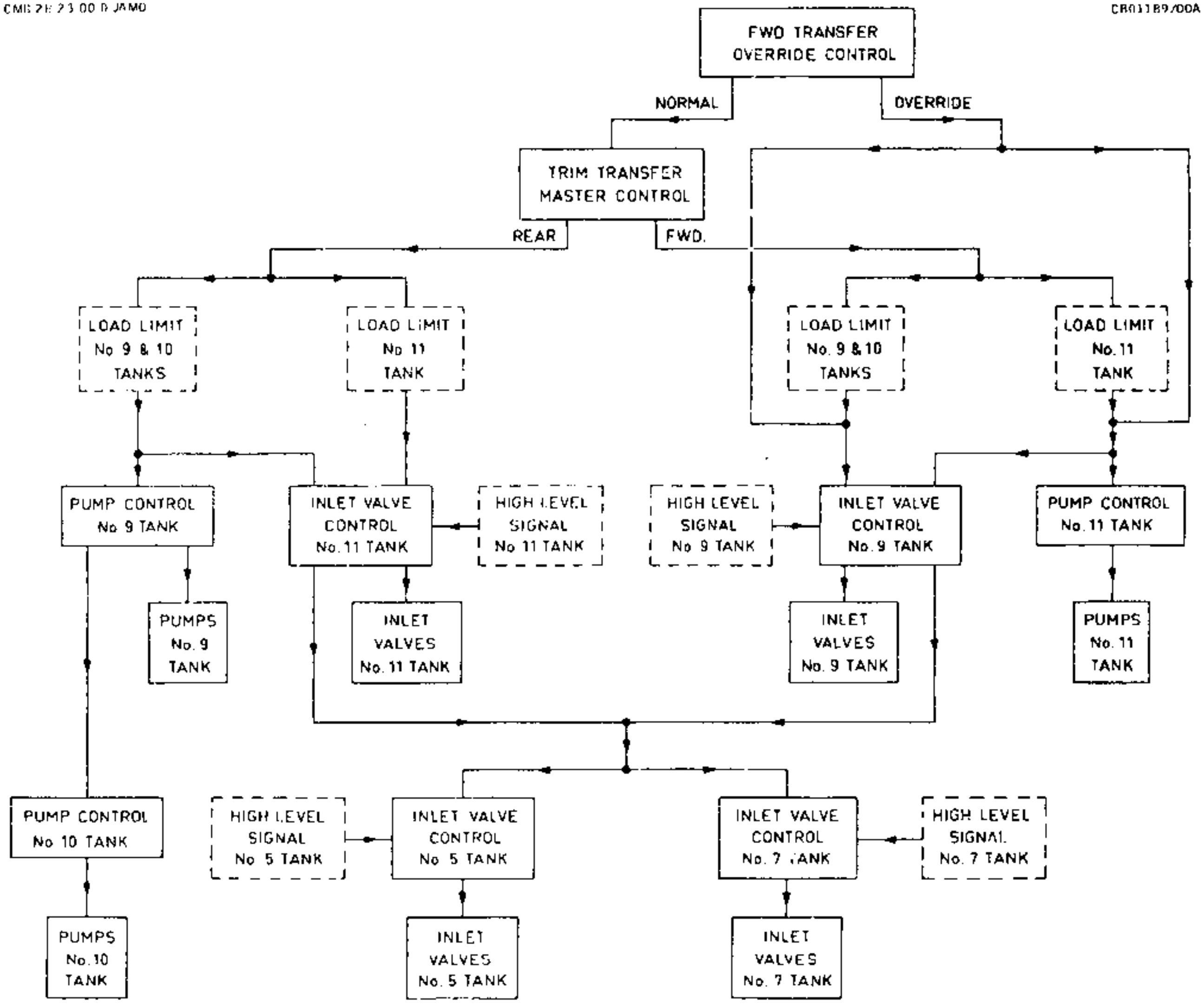

- Trim Transfer - Block Diagram
Figure 010

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control.

C. Inlet Valve Control (Ref. Fig. 011)

The twin motors of each trim inlet valve are controlled independently by a MAIN switch for the normal motor and an O/RIDE switch for the standby motor.

The OFF position of the O/RIDE switch places the inlet valve under the control of the MAIN switch. The OPEN and SHUT positions of the O/RIDE switch isolate the MAIN switch and directly control the standby motor.

The electrical supply to the normal motor of each inlet valve is switched by a valve control relay. A control relay is automatically de-energized to shut the inlet valve if fuel within the tank reaches high level.

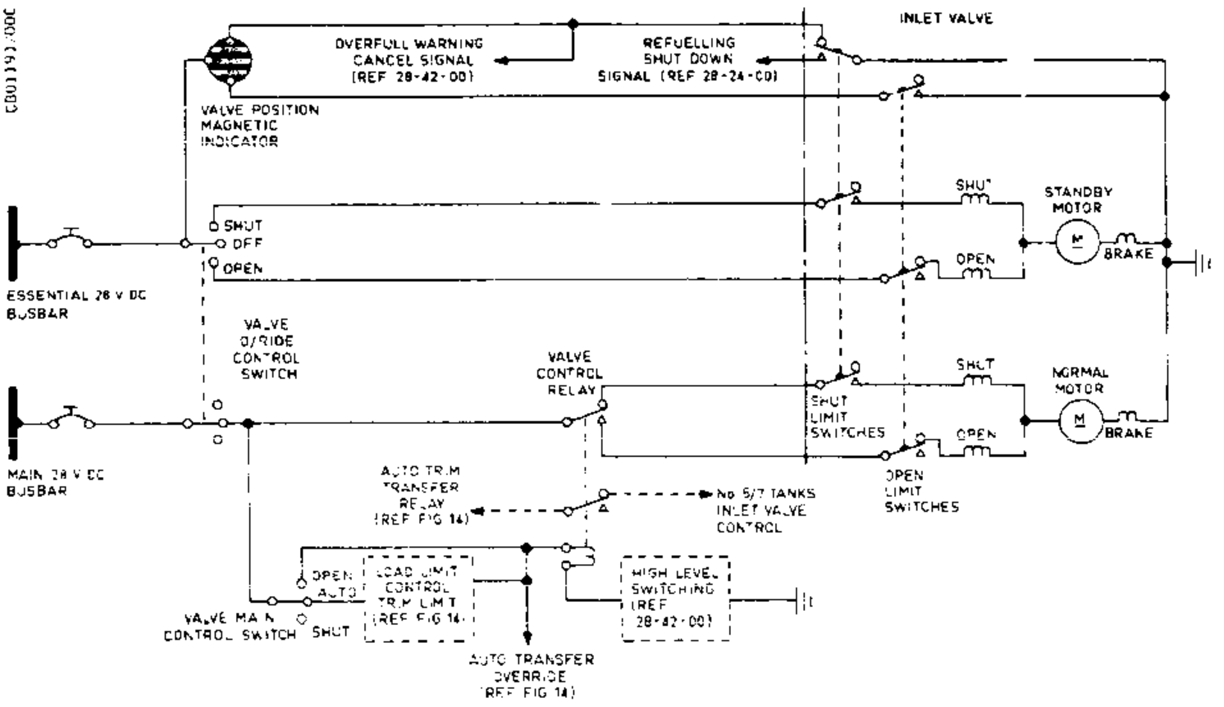
The OPEN and SHUT positions of the MAIN control switch directly energize or de-energize the valve control relay to open or shut the inlet valve by the normal motor. The AUTO position of the control switch brings the valve control relay under the control of the selected load limit. The inlet valves for tanks 5 and 7, when trim transfer pumps are running, are automatically opened via the associated valve control relays when both inlet valves, either of tank 9 or tank 11, shut due to a pre-selected load limit or a high level.

A 'shut' indication signal from each tank inlet valve is used to cancel any overfull level signal for the tank when the valve is closed.

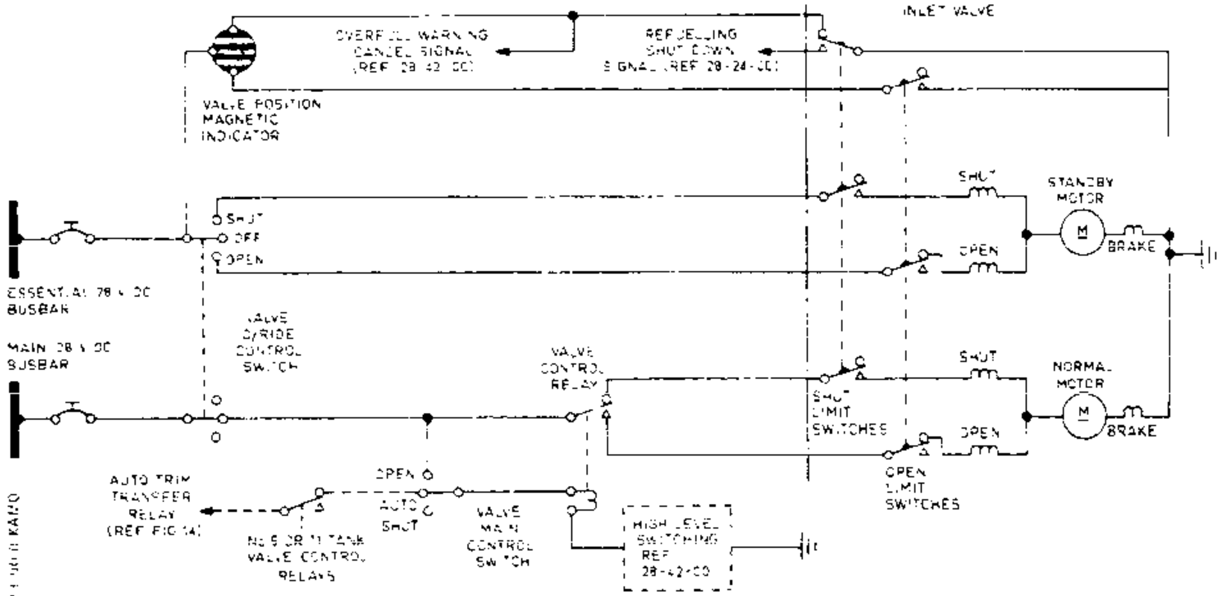
D. Forward Pump Control (Ref. Fig. 012)

The supply to each pump is switched by a contactor which is controlled either directly from the ON position of the pump control switch or from the AUTO position of the switch, via a pump control relay, during a rearward trim transfer operation.

During a rearward trim transfer operation the pumps in tank 9 commence operating immediately, but the pumps in tank 10 are 'held-off' until low pressure is sensed by tank 9 pressure switches, i.e., tank empty. Time delay units are incorporated which prevent tank 10 pumps from operating until a predetermined time after tank 9 pumps low pressure is indicated. The pumps in both tanks switch off by operation of the load level control switch for tank 10.

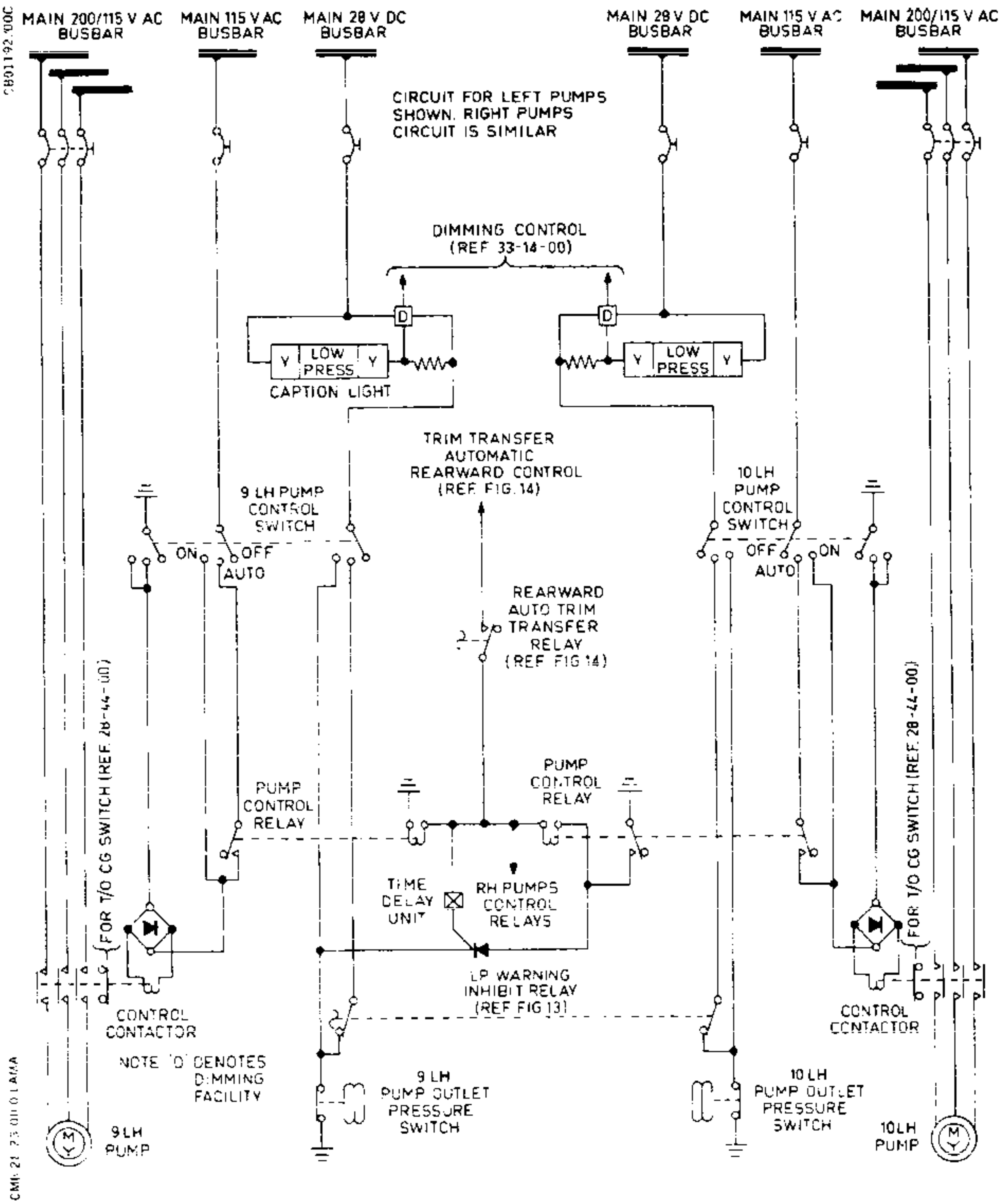


TYPICAL VALVE CONTROL TANKS 9 OR 11



TYPICAL VALVE CONTROL TANKS 5 OR 7

- Inlet Valve Control - Simplified Schematic
Figure 011



- Forward Pump Control - Simplified Schematic
(Sheet 1 of 2) Before SB 28-048
Figure 012

A magnetically latched T/O CG switch (Ref. 28-44-00) is energized, via auxiliary contacts of tanks 9 and 10 pumps contactors, when the switch is set to 54 % and tanks 9 and 10 pumps are switched off. The latching supply is grounded via pumps 9 LH and 10 LH contactors and pumps 9 RH and 10 RH contactors in a series-parallel configuration.

After SB 28-048 For A/C 001-005,

D. Forward Pump Control (Ref. Fig. 012)

The pumps are switched on by the pump control switch, either directly when the switch is at ON, or, when the switch is at AUTO, via a pump control relay during automatic rearward transfer.

During the first 5 s of the pump starting period, the pump start control unit inhibits the pump contactor operation and controls the three-phase supply to linearly extend the starting period.

A pulsed-driver circuit supplies electrical power in a pulsed train that has a mark-space ratio which changes from 5 % power on, 95 % power off, on the initial pulse, to 100 % power on after 5 s.

After 5 s, the 5 s timer causes the pump contactor coil to be energized. An auxiliary contact in the pump contactor then provides a lock-on function for the pump contactor; thereafter during the pump running period the pump is contactor-controlled.

The 6 s timer inhibits the pulsed-driver circuit and will also cause the pump contactor coil to be energized if the 5 s timer has not operated.

Indicators on the front panel of the control unit comprise three neon lamps and two light-emitting diodes (LEDs). The neon lamps, identified A, B and C, are lit when aircraft electrical power is on. When the pump is first switched on, the lights will gradually dim until at the end of the 5 s period they are extinguished. The LEDs, identified 5 and 6, become illuminated respectively at the end of the 5 s and 6 s periods of the starting cycle.

The control unit is protected against overheating by thermal fuses, and is rated for not more than five starts in the first 5 min of any 15 min period.

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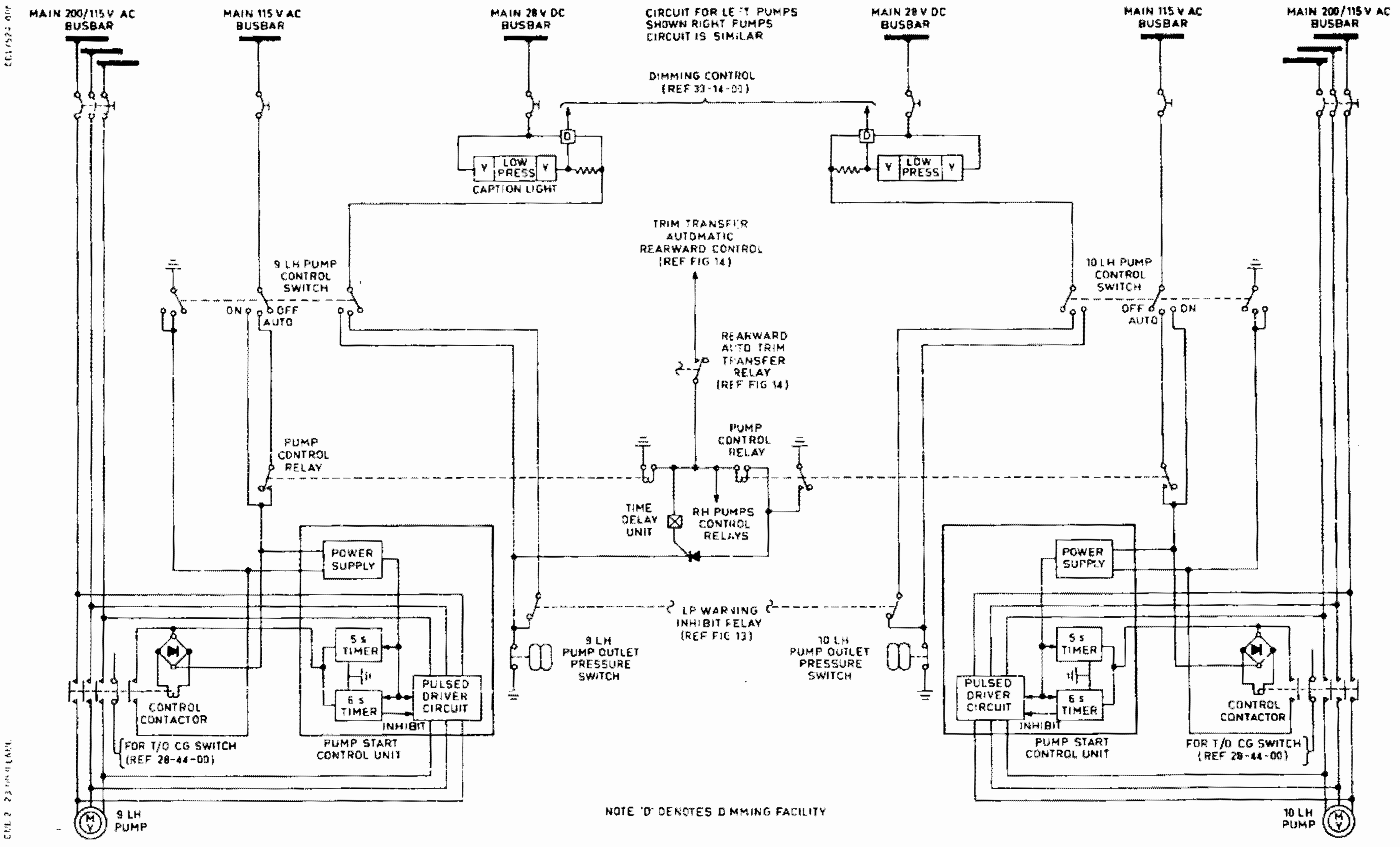


Forward Pump Control - Simplified Schematic
(Sheet 2 of 2) After SB 28-048
Figure 012

During a rearward trim transfer operation the pumps in tank 9 commence operating immediately, but the pumps in tank 10 are 'held-off' until low pressure is sensed by tank 9 pressure switches, i.e., tank empty. Time delay units are incorporated which prevent tank 10 pumps from operating until a predetermined time after tank 9 pumps low pressure is indicated. The pumps in both tanks switch off by operation of the load level control switch for tank 10.

A magnetically latched T/O CG switch (Ref. 28-44-00) is energized, via auxiliary contacts of tanks 9 and 10 pumps contactors, when the switch is set to 54 % and tanks 9 and 10 pumps are switched off. The latching supply is controlled via pumps 9 LH and 10 LH contactors and pumps 9 RH and 10 RH contactors in a series-parallel configuration. Because the pump start control units impose a 5 s time delay on the energizing of tanks 9 and 10 pump contactors, there will be a time delay of 5 s after the pumps are switched on before the T/O CG switch resets to NORM.

E. Rear Pump Control (Ref. Fig.013 and 014)

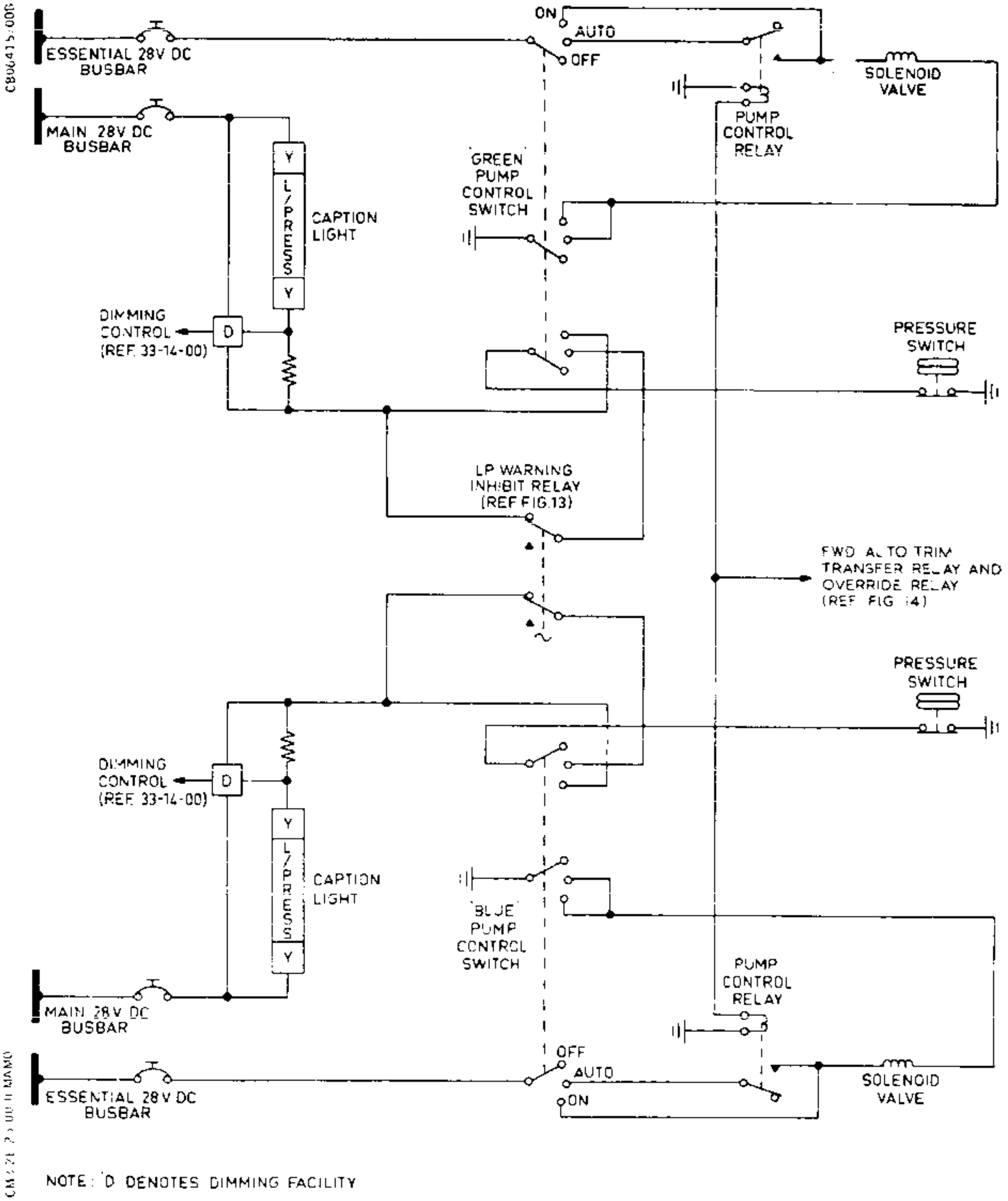
The solenoids of the electro-hydraulic selector valves for the green and blue hydraulic pumps are independently controlled, either directly from the ON position of the pump control switch or from the AUTO position of the switch, via a pump control relay, during a forward trim transfer operation.

The left and right electric pump control switches, engraved ON - AUTO - OFF, control the corresponding pumps, directly in the ON position and via the auto trim transfer and override relays in the AUTO position. A yellow LOW PRESS caption is illuminated to give warning of low fuel pressure delivery by the associated pump when the switch is at ON or AUTO. A de-aeration switch, together with the rearward auto trim and de-aeration/trim interlock relays, permits the left-hand electric pump to be used for de-aeration. The de-aeration/trim interlock relay prevents the pump being used for de-aeration when rear trim transfer is taking place.

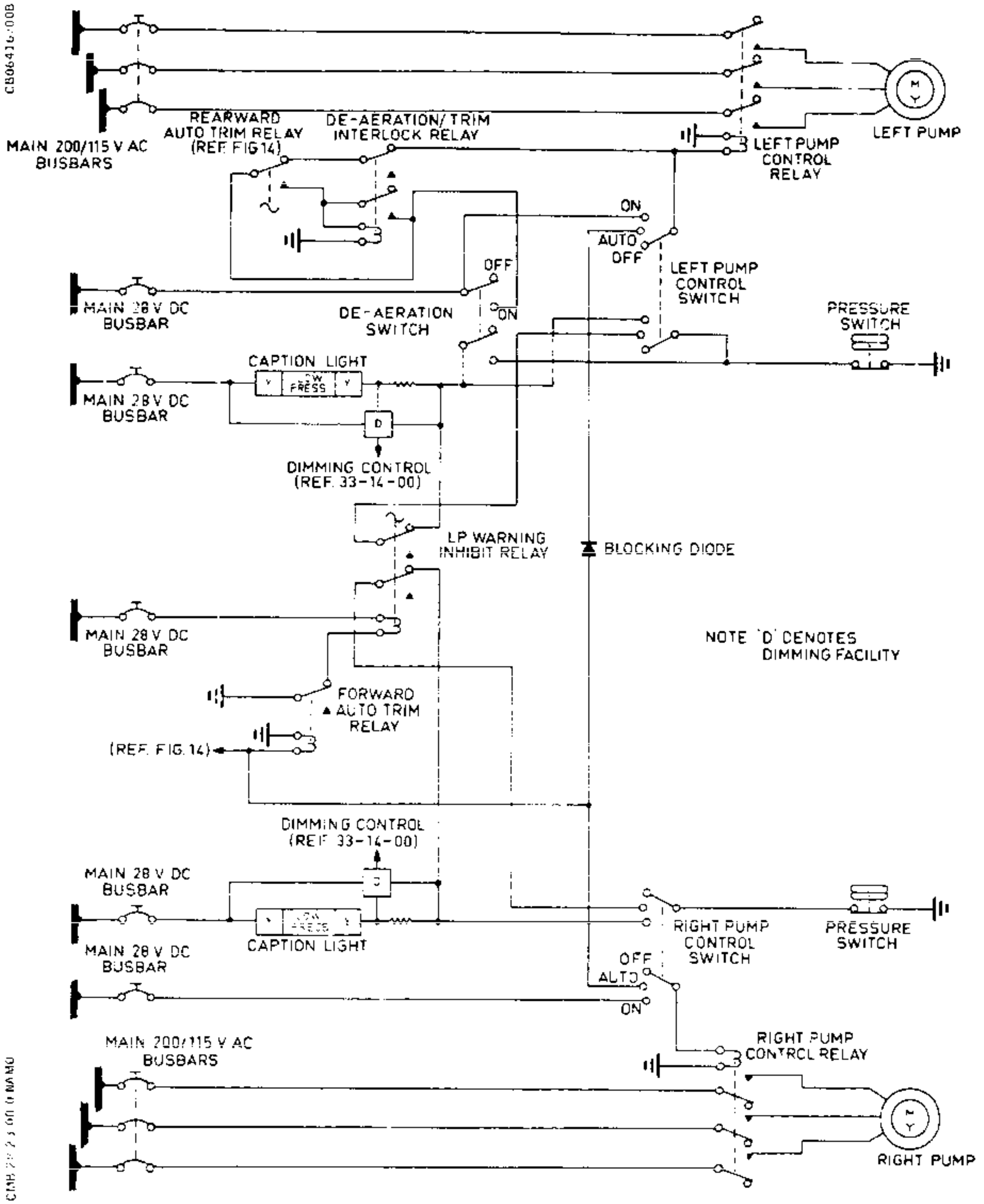
The forward auto trim relay controls the LP warning inhibit relay to prevent LP warning when forward trim transfer is in progress.

F. Automatic Master Control (Ref. Fig. 015)

NOTE: All appropriate valve and pump control normal



Rear Pump (Hydraulic) Control - Simplified Schematic
Figure 013



Rear Pump (Electric) Control -
Simplified Schematic
Figure 014

switches must be set to AUTO and override switches to OFF, for automatic operation.

With the trim transfer auto master switch set to FORWARD, the tank 11 pumps are controlled via tank 11 load limit control and the forward auto trim transfer relay. Tank 9 inlet valves are controlled via tanks 9 and 10 load limit control.

With the trim transfer auto master switch set to REARWARD the tanks 9 and 10 pumps (in sequence) are controlled via tanks 9 and 10 load limit control and the rearward auto trim transfer relay. Tank 11 inlet valves are controlled via tank 11 load limit control.

The inlet valves for tanks 5 and 7 are automatically brought under the control of an auto trim transfer relay when both inlet valves in a trim tank close during an automatic transfer. The supply to tanks 5 and 7 inlet valves is completed via the two inlet valve control relays, either of tank 9 or tank 11, when both relays become de-energized due to preselected load limit being reached or the fuel in the associated tank reaching high level.

G. Override Control (Ref. Fig. 015)

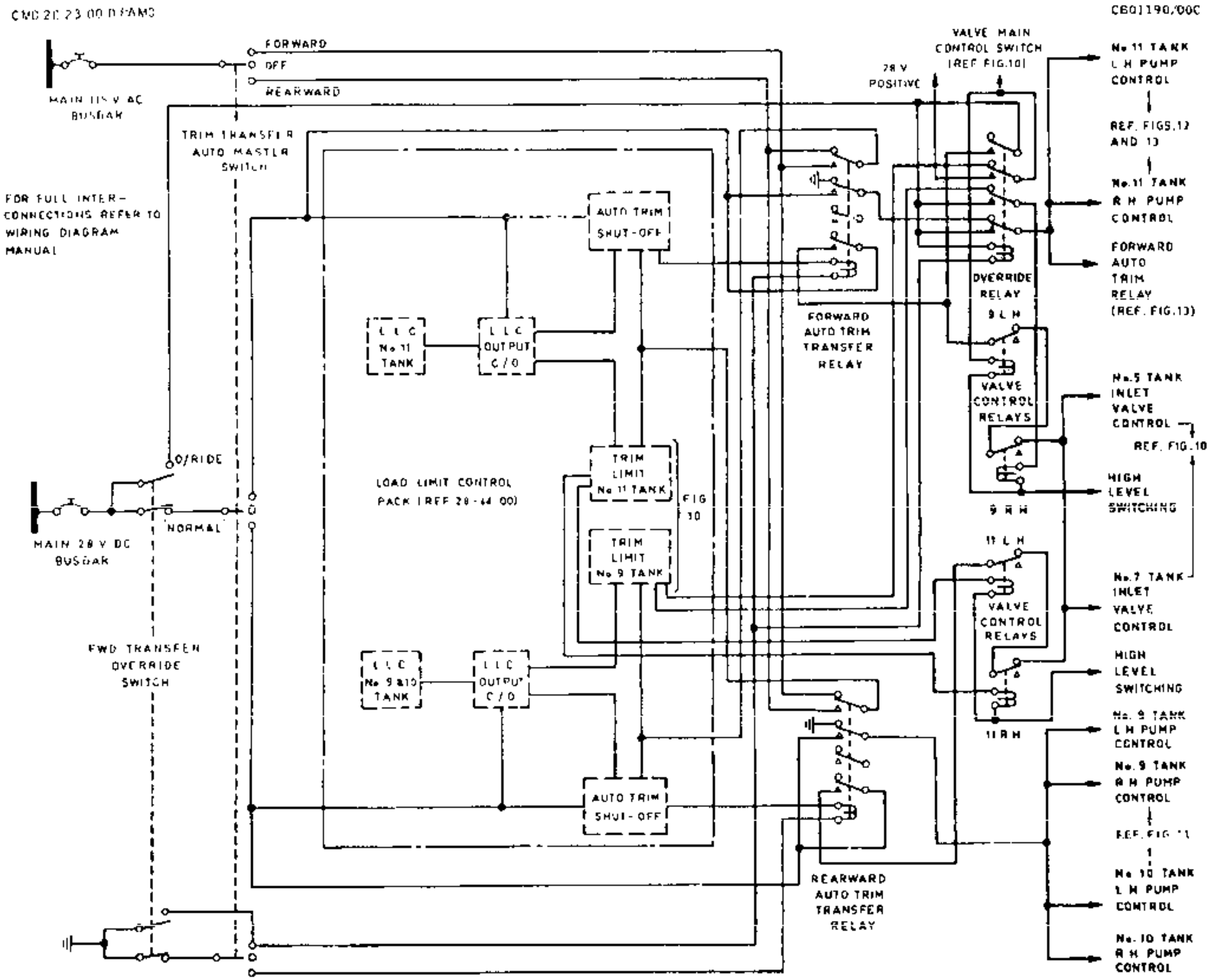
The O/RIDE position of the forward transfer override switch isolates the supply to the master switch and directly energizes the override relay to run the pumps in tank 11 and, irrespective of any preselected load limit, opens the tank 9 inlet valve.

H. Manual Control

NOTE: For transferring fuel on the ground reference should be made to 28-00-00, 'Servicing - Fuel Transfer on the Ground'.

With the TRIM TRANS AUTO MASTER switch at off (centre position and guarded) the pumps and valves can be operated manually by setting the PUMPS switches to ON or OFF, the MAIN inlet valve switches to OPEN or SHUT, the OVERRIDE switches to OPEN or SHUT and the STANDBY INLET VALVES switches to OPEN or SHUT. Except when they are under the control of the OVERRIDE switches, the valves will automatically close if the fuel in the associated tank reaches 'high' level.

11. Electrical Power Supplies



- Automatic Master Control - Simplified Schematic
Figure 015

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Electrical power supplies for inlet valves, pumps and automatic transfer control are detailed in Table 1.

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
INLET VALVE		
Tank 9 LH		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213
Tank 9 RH		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213
Tank 11 LH		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213
Tank 11 RH		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213
Tank 5		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213
Tank 7		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
AUTOMATIC SYSTEM		
Automatic trim transfer control	'B' main 28 V d.c.	15-216
Automatic trim transfer supply	No.3 main 115 V a.c.	13-216
PUMP		
Tank 9 LH		
Supply	No.1 main 115/200 V a.c.	14-215
Control	No.1 main 115 V a.c.	14-215
Indication	'A' main 28 V d.c.	15-215
Tank 9 RH		
Supply	No.3 main 115/200 V a.c.	13-216
Control	No.3 main 115 V a.c.	13-216
Indication	'B' main 28 V d.c.	15-216
Tank 10 LH		
Supply	No.4 main 115/200 V a.c.	14-216
Control	No.4 main 115 V a.c.	14-216
Indication	'B' main 28 V d.c.	15-216
Tank 10 RH		
Supply	No.2 main 115/200 V a.c.	13-215
Control	No.2 main 115 V a.c.	13-215
Indication	'A' main 28 V d.c.	15-215
Tank 11 green		
Supply and control	'A' essential 28 V d.c.	1-213
Indication	'B' main 28 V d.c.	15-216
Tank 11 blue		
Supply and control	'B' essential 28 V d.c.	3-213
Indication	'A' main 28 V d.c.	15-215
Tank 11 (electric) LH		
Supply	No.3 main 115/200 V a.c.	13-216
Control	'B' main 28 V d.c.	15-216
Indication	'A' main 28 V d.c.	15-215

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Tank 11 (electric) RH		
Supply	No.2 main 115/200 V a.c.	13-215
Control	'A' main 28 V d.c.	15-215
Indication	'B' main 28 V d.c.	15-216
Tanks 9, 10 and 11 LP warning inhibit	'B' main 28 V d.c.	15-216

Electrical Power Supplies
Table 1

**ON A/C 006-007,

TRIM TRANSFER SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

R **ON A/C 006-007,

B WARNING: FUEL TRIM TRANSFER INLET VALVES SHOULD REMAIN
B SHUT AT ALL TIMES, EXCEPT WHEN BEING OPERATED
B FOR A SPECIFIC MAINTENANCE TASK. ENSURE
B VALVES ARE SHUT BEFORE VACATING FLIGHT DECK.

B NOSE GEAR SHOCK ABSORBER EXTENSION IS A GOOD
B INDICATION OF AIRCRAFT OVERBALANCE AND SHOULD
B NEVER EXCEED 23.5 INS (596 mm).

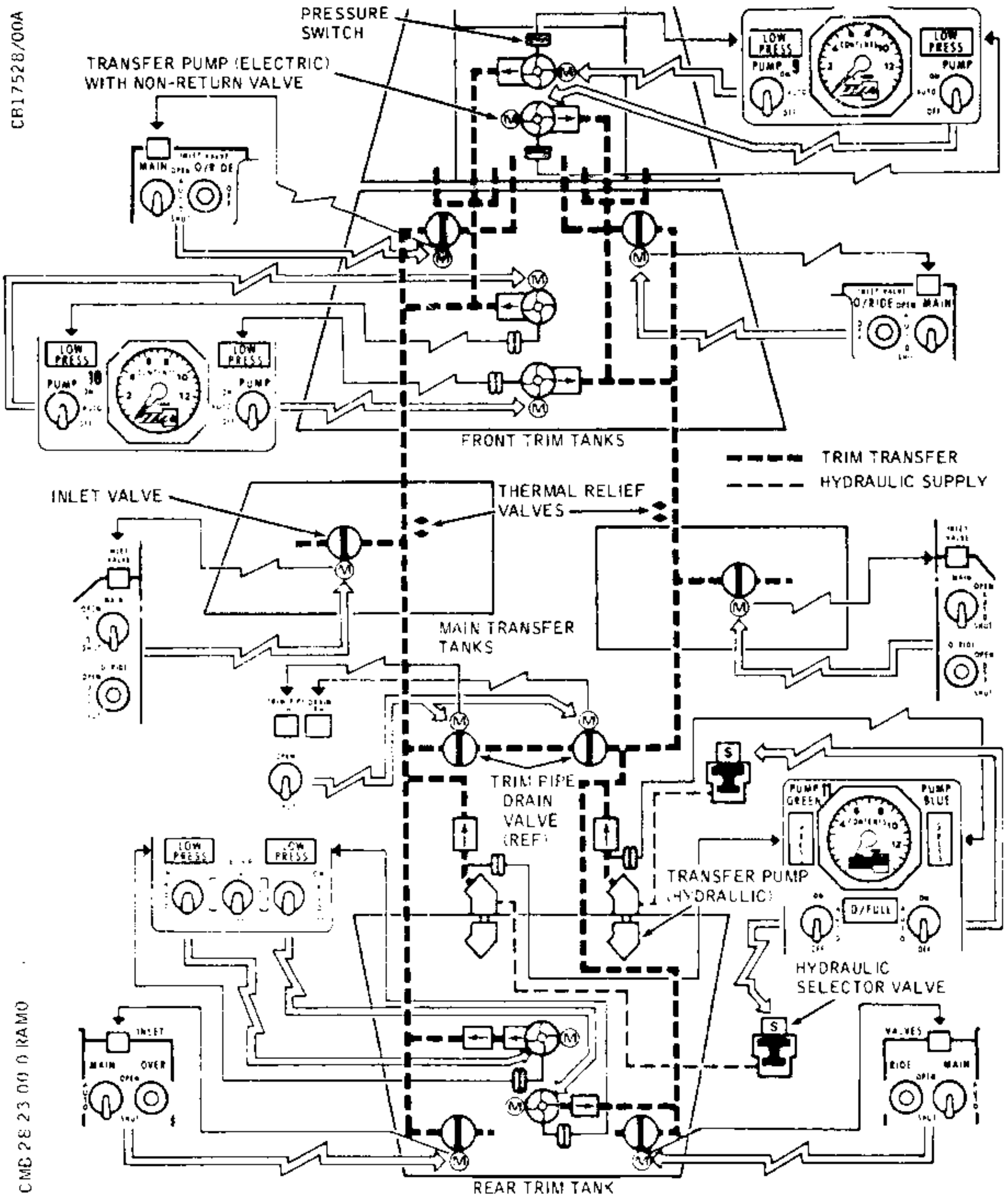
**ON A/C 006-007,

The trim transfer system transfers fuel between the front and rear trim tanks, to move the aircraft centre of gravity in accordance with aerodynamic centre of pressure movement during take-off and transonic acceleration and deceleration.

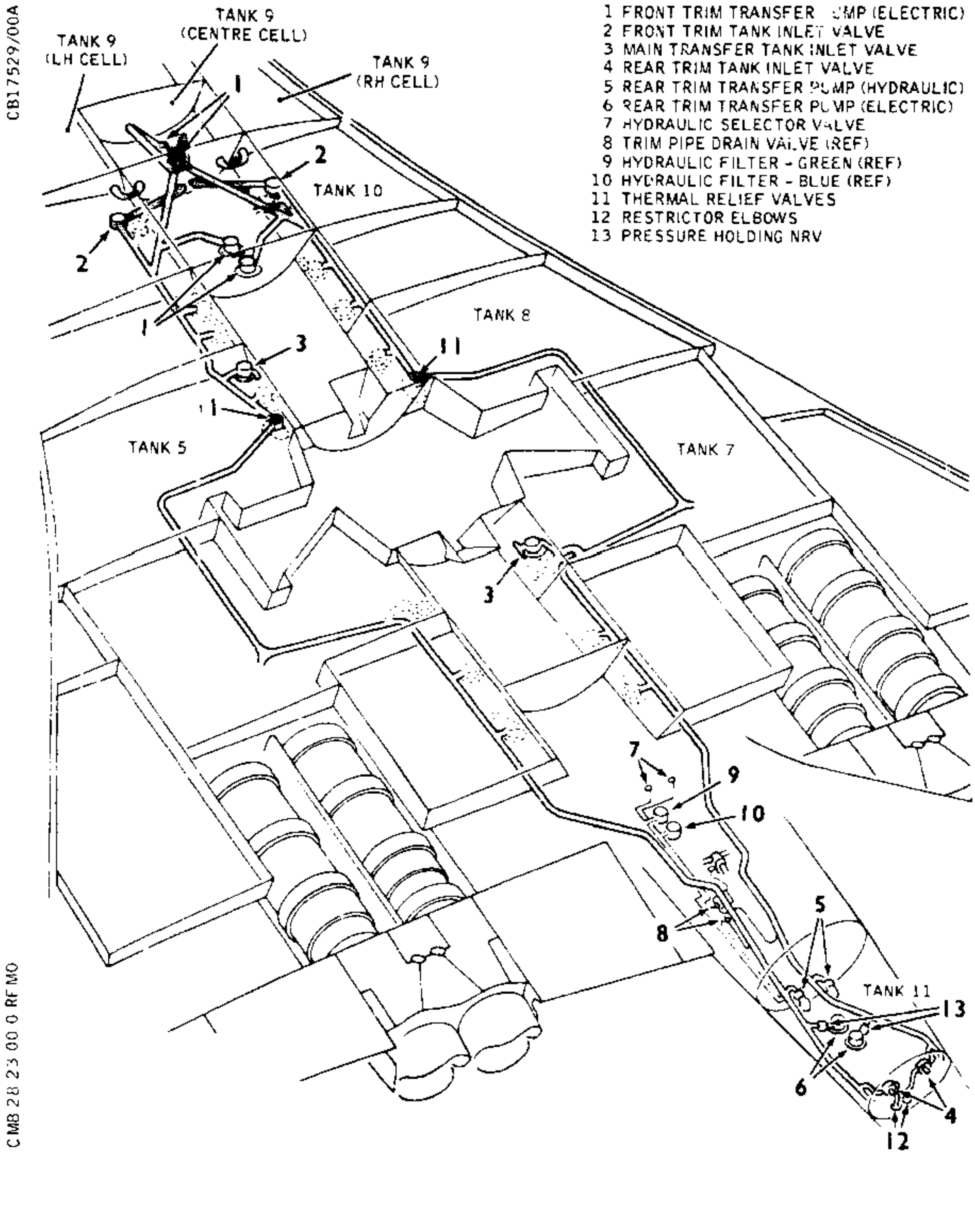
At the start of supersonic cruise the required rearward movement of the centre of gravity is obtained by transferring fuel from the front tanks (9 and 10) to the rear tank (11). Conversely, at the end of supersonic cruise, the required forward movement is obtained by transferring fuel from tank 11 to tank 9. Fuel in excess of trim tank requirements is transferred to the main transfer tanks 5 and 7 from where it is made available to the engines via the collector tanks.

Fuel is conveyed between the front and rear trim tanks by two completely separate trim transfer pipes, one in each side of the aircraft, extending through the main tanks, and the rear fuselage. As a means of relieving fuel pressure, when all inlet valves are closed and a temperature change occurs either in flight or on the ground, thermal relief valves are installed in each trim transfer pipe. The left-hand pipe connects with main transfer tank 5 and the right-hand pipe with main transfer tank 7. Electric motor-driven inlet valves control the flow of fuel from the trim pipes to all trim tanks and main transfer tanks 5 and 7. Additional control valves and components connected to the trim transfer pipes enable them to be adapted for refuel, defuel, and dump operations (Ref. 28-24-00, 28-25-00 and 28-31-00).

Fuel from the front trim tanks is pumped rearward by four electric motor-driven pumps mounted in the tanks. These are controlled by separate switches and fed from independent



- Trim Transfer - Schematic
Figure 001



- Trim Transfer System - Component Location
Figure 002

circuits arranged to obviate the total loss of pumping capacity in the event of partial electrical power failure.

The starting of the front trim tanks pumps is electronically controlled.

Restrictors are built into tank 11 inlet elbows to achieve the optimum fuel system management procedure for rearward trim transfer.

For forward trim transfer, rear trim tank 11 contains four pumps, two hydraulically driven and two electrically driven. Normal forward transfer is by the two hydraulic pumps, the electric pumps being standby pumps.

All the pumps, both electric and hydraulic, are installed in isolation canisters to facilitate removal without defuelling. A pressure switch, connected to each pump outlet, gives a low fuel pressure warning. Restrictor unions are used in the pressure switch supplies to limit the amount of fuel leakage if the supply pipe becomes fractured. The pump control switches and indicators are situated on the fuel system management panel at the third crew member's station.

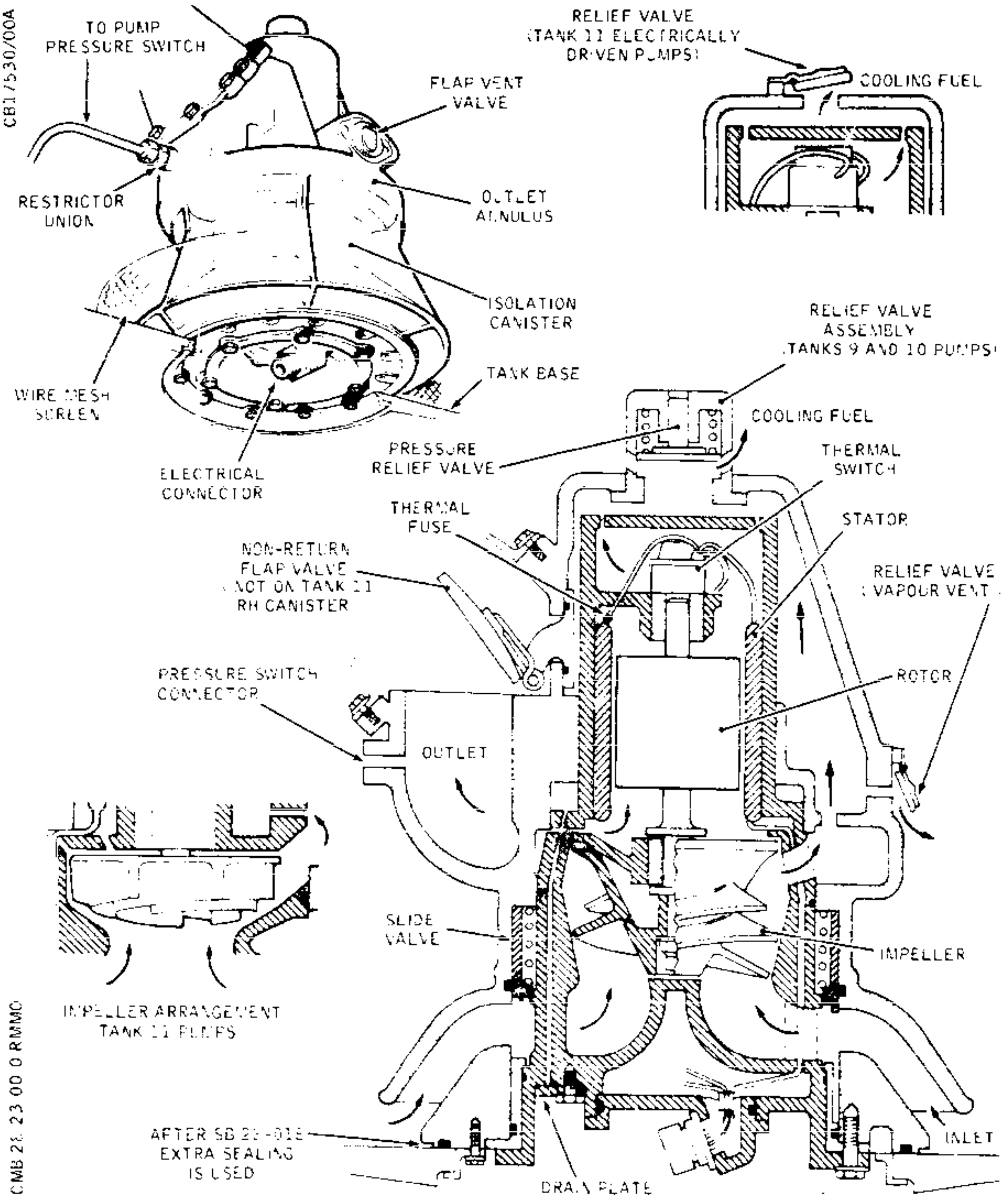
Transfer of fuel is automatically controlled by the load limit section of the fuel quantity indication system (Ref. 28-44-00). The specific amounts of fuel required in the trim tanks are preselected on the load limit selectors on the fuel management panel.

Each tank inlet valve has two motors powered by separate electrical supplies. One motor is controlled either manually or automatically and the other, which is connected to an emergency power source, is controlled manually and overrides any signals previously given automatically.

The controls and indicators for the trim transfer system are laid out in a fuel flow form on the fuel system management panel. An automatic transfer selection activated at this panel can be overridden by an emergency forward transfer switch located on the pilot's roof panel.

2. <u>Trim Transfer Pump - Electrically Driven</u> (Ref. Fig. 003)

The six electrically driven pumps, two in each of tanks 9, 10 and 11, are basically similar. Each comprises an electric motor-driven, low pressure, centrifugal pump element, mounted in an isolation canister bolted to the tank floor. The motors use 200 V, three-phase, a.c. power and are independently controlled by switches on the fuel management panel.



\- Trim Transfer Pump - Electrically Driven
Figure 003

The pump element comprises an inlet housing, a bearing housing and a stator housing bolted together to house a motor and a shaft-mounted impeller. The pump is completely flooded with fuel for cooling the motor and lubricating the bearings.

The motor, which comprises a rotor and a wound stator, is a three-phase, star-connected, squirrel cage induction motor. The star connection is made through a thermal switch mounted in the stator housing and connected to an electrical connector which is mounted on a lead wire cover. Thermal fuses are incorporated in the stator windings. Split carbon bearings mounted in sleeves in the castings support the rotor shaft. Pins, slot-located in the castings, prevent bearing rotation and a strip-spring loads the bearing against the shaft to compensate for wear and expansion. If the temperature of the motor rises to between 154 and 166 deg C (309 and 330 deg F) the thermal switch contacts open to interrupt the supply to the stator windings. When the temperature of the motor has fallen to between 120 and 132 deg C (248 and 269 deg F) the thermal switch contacts close to reinstate the supply to the stator windings. The thermal fuses rupture at 202 deg C (395 deg F).

Each pump has a spring-loaded non-return valve in its outlet that acts as a pressure maintaining valve and prevents reverse flow when the pump is inoperative. For each tank 9 and 10 pump and each tank 11 hydraulic pump, the valve is installed in the pump isolation canister outlet. For each tank 11 electric pump the valve is mounted in-line in the trim transfer pipe. In addition, the tank 11 LH electric pump has a spring-loaded flap non-return valve in the isolation canister outlet to prevent reverse flow from the de-aeration system when the pump element is removed. The pump inlets are protected against the ingress of any foreign matter and water by filter screens and dams.

The isolation canisters for all the electric pumps comprise a cast aluminium-alloy canister assembly machined to accommodate the pump element, a spring-loaded slide valve, a vapour vent valve, a relief valve and inlet and outlet ports. The slide valve, which is located in the inlet port, is retained by the valve seat and valve rotation is prevented by a tongue in the valve which engages in a slot in the seat. A pin, pressed into the side of the canister, locates the pump element and prevents complete withdrawal of the element during the initial stage of element removal.

3. Pressure-holding Non-return Valve (Ref. Fig. 004)

The valve is mounted in-line with each tank 11 electric pump outlet and the trim transfer pipe.

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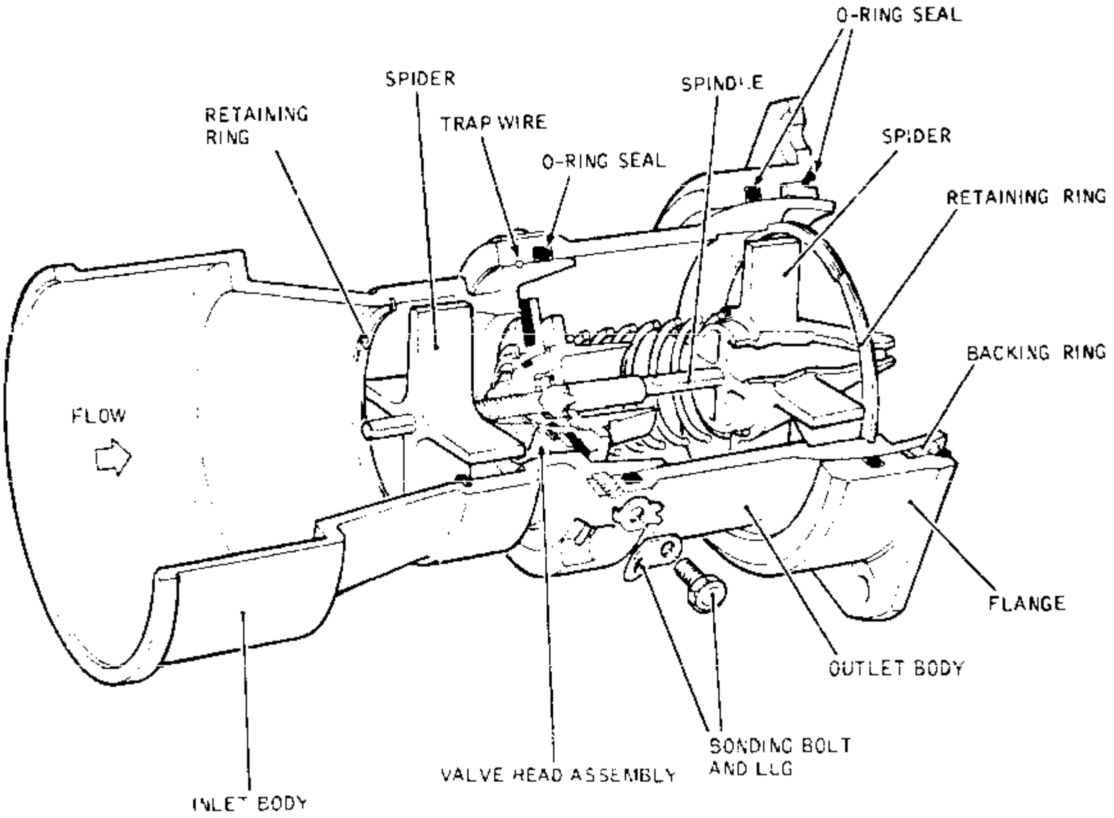

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Pressure-holding Non-return Valve
Figure 004

The valve comprises an inlet and outlet body secured together with a trapwire to form a housing. To provide flexibility, a flange with a hemispherical inner surface fits over a hemispherical surface of the outlet body. The flange, complete with O-ring seals and backing ring, is assembled to the outlet body during installation.

The housing supports two spiders with a spindle. The spindle has a valve head assembly secured to it. The valve head assembly is spring-loaded against the inner face of the inlet body. Fuel pressure above 1.75 psig (0.1208 bar) at the inlet will overcome the spring loading and lift the valve head off its seating.

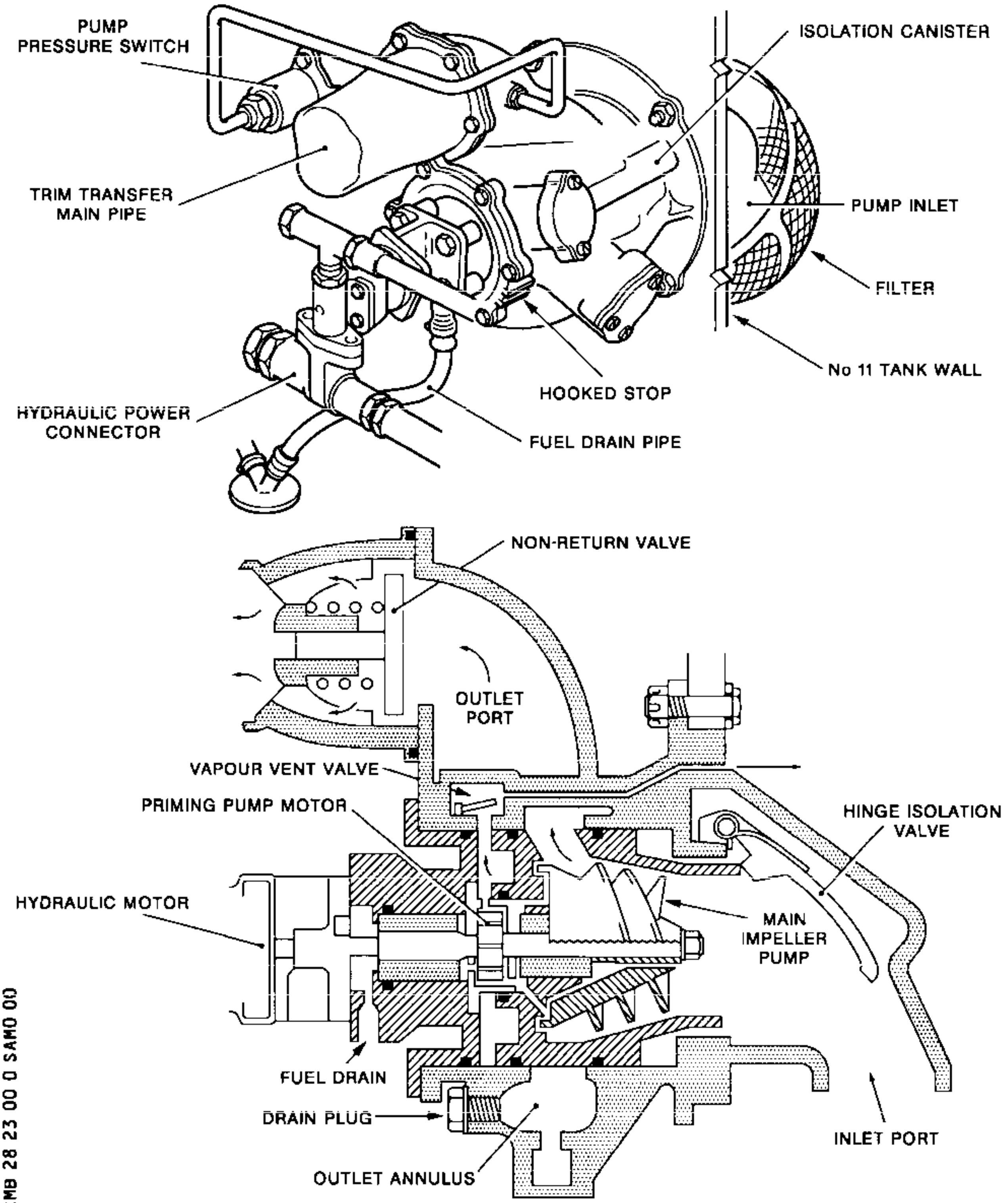
4. Trim Transfer Pump - Hydraulically Driven (Ref. Fig. 005)

Two identical (left and right), hydraulic motor-driven pumps are fitted in tank 11 and deliver fuel into the left and right trim transfer pipes. Each pump element is mounted in an isolation canister which is bolted to the outside of the tank forward wall, with the canister inlet port duct projecting through the wall into the tank. The pumps can also be used to jettison fuel overboard. The left and right pumps are powered by the GREEN and BLUE hydraulic systems respectively (Ref. 29-00-00). Pressure is directed to each pump by a solenoid-operated selector valve mounted on each hydraulic system distribution manifold. The valves are independently controlled by switches on the fuel management panel.

The pump element consists of a hydraulic motor, driving a main pump impeller and a priming pump rotor, both mounted on a single shaft, lubricated by fuel. A flexible pipe from the rear bearing housing enables any fuel entering the housing to drain overboard via a vent in the aircraft skin. Fuel is drawn into the pump body through a large single inlet port concentric with the driving shaft and discharged into an outlet annulus in the isolation canister.

The priming pump prevents an air lock occurring at the impeller if the impeller becomes uncovered by fuel. The pump draws air and fuel through a drilling in the centre of the impeller and discharges it through a vent valve in the canister casing, back into the fuel tank. The vent valve is closed by a spring to isolate the fuel in the tank when the pump is removed.

Two external fuel ducts are integral with the isolation canister casing. One, from inside the tank, leads to the pump inlet port and the other stems from the canister outlet annulus and connects with the trim transfer pipe system.



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Trim Transfer Pump - Hydraulically Driven
Figure 005

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With the pump element installed, a lug at its inlet port projects into the canister inlet port to hold open a hinged isolation flap valve.

A hooked stop on the pump casing prevents complete withdrawal of the pump during its initial stage of removal, thus enabling any fuel trapped in the pump to be drained off before separating the pump from the isolation canister.

Removal of the pump element causes the flap valve to close under spring pressure to isolate the canister inlet port from the fuel in the tank. The canister outlet port contains a spring-loaded, non-return poppet valve, which prevents gravity flow of fuel out of the tank when the pump is inoperative, but prevents a reverse flow to the tank.

5. Hydraulic Fuel Transfer Pump Drive Motor (Ref. Fig. 006)

A drive motor is bolted to each pump mounted on the forward bulkhead at tank 11.

The hydraulic fuel transfer pump drive motor is a fixed stroke, axial piston type having a constant displacement. Its flow and speed are maintained constant by an integral flow control valve located at the inlet side of the motor. It is used in conjunction with the aircraft hydraulic system to translate hydraulic power into rotary motion to drive a fuel transfer pump.

Fluid from the aircraft hydraulic system is fed, via the inlet port and flow control valve, through a kidney-shaped slot in the valve block and wafer plate into piston bores in the cylinder block. The pistons move away from the valve block when under pressure, causing rotation of the drive shaft due to the angle of displacement, and so driving the fuel pump.

When the pistons reach the lowest point of travel down the inlet side they will begin to rise on the outlet side, transferring fluid through a second kidney-shaped slot in the wafer plate and valve block to the outlet port. This fluid is forced at low pressure back to the hydraulic reservoir, thus completing the cycle.

Fluid flowing through the inlet port above a predetermined value causes the flow valve piston to move against the force of the spring. Outlet holes in the piston leading to the valve block inlet port become partially covered, reducing the flow as necessary to maintain a constant flow and speed to the motor.

6. Hydraulic Selector Valve (Ref. Fig. 007)

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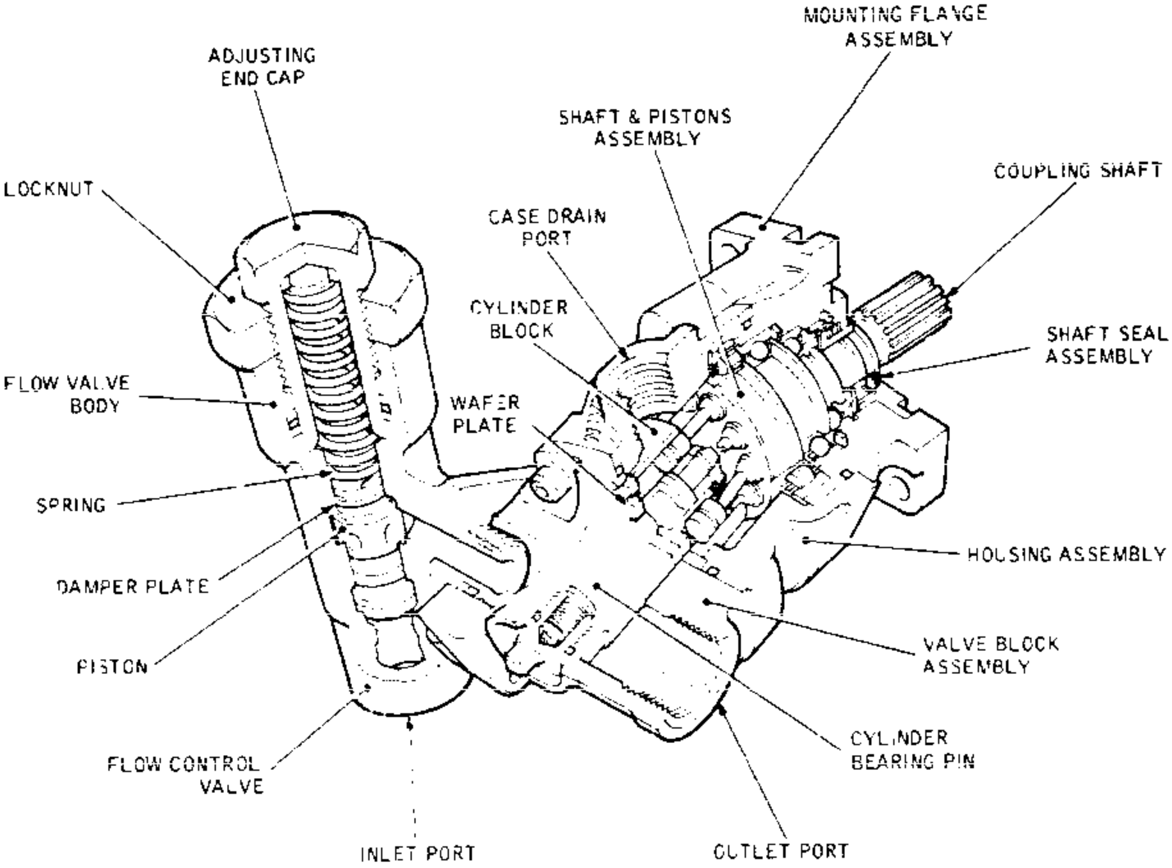

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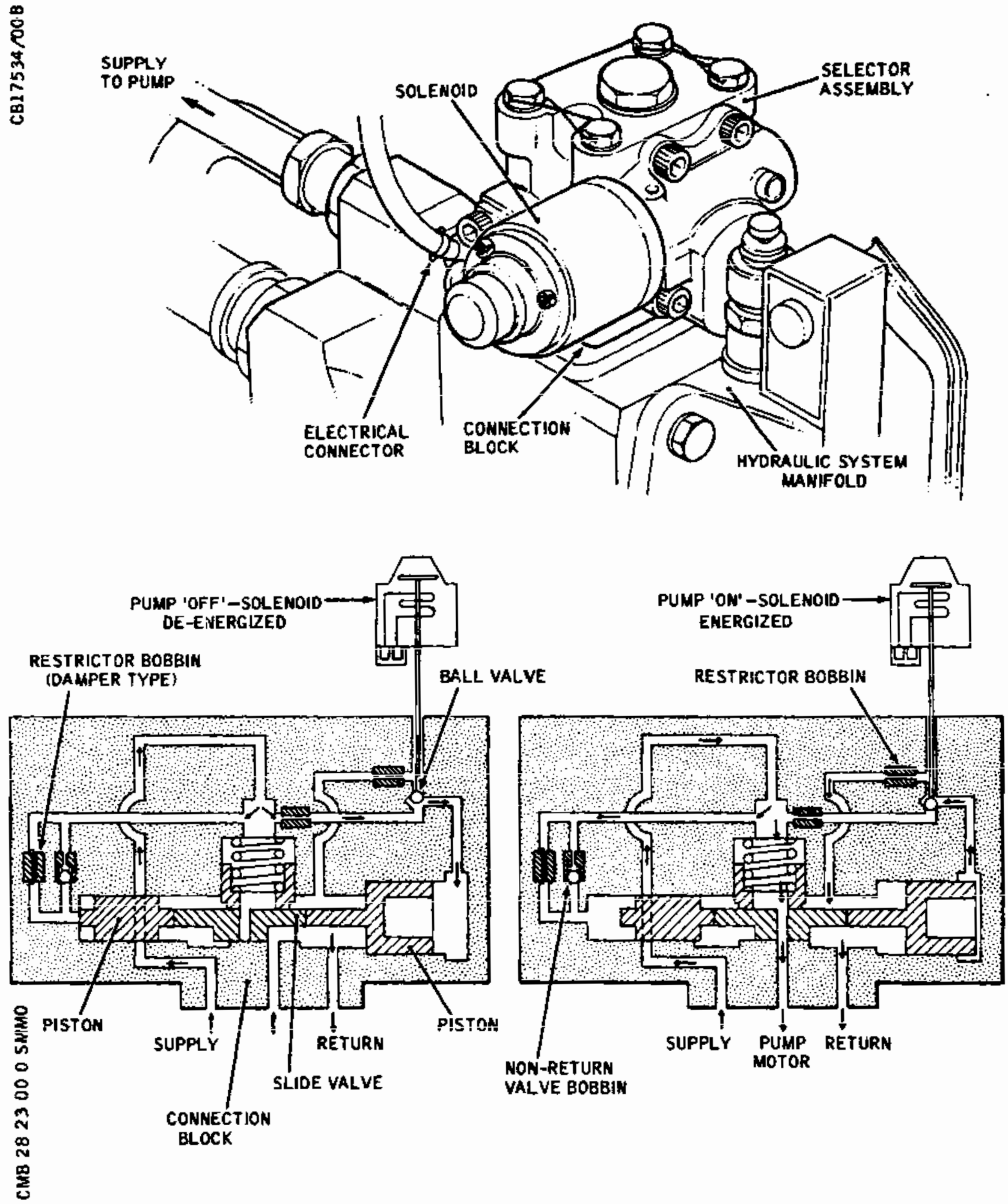
\- Hydraulic Fuel Transfer Pump Drive Motor
Figure 006



R Hydraulic Selector Valve
Figure 007

Electrically operated valves control each rear transfer hydraulic pump. Each valve is mounted on the manifold of the hydraulic system which supplies the associated pump motor; independent control switches are located on the fuel management panel.

The base of the unit forms a hydraulic connection block with the manifold. Contained in the unit body is a spring-loaded slide valve operating across the service port in the connection block. The slide valve is moved by two opposing pistons of different diameters. Pressure supply to the larger piston is controlled by a ball valve contained within pressure and return seats in the fluid ducts. A solenoid - operated spindle is located through the return seat and held away from the ball by a spring. Pressure supply to the smaller piston is direct and constant.

With the pump control switch set to OFF, the solenoid is de-energized and the spindle held out, permitting fluid pressure to force the ball against the return seat and allow flow to the larger piston. The difference in surface areas of the pistons allows a greater force to be applied on the larger piston, resulting in the piston being held at the limit of its travel. In this condition the slide valve is positioned so that it blanks off the service port to the pump motor, but allows fluid entering the unit to return to the manifold.

When the pump control switch is set to ON, the solenoid is energized, causing the spindle to push the ball against the pressure seat. With the pressure supply cut off from the larger piston, the pressure on the smaller piston moves the port in the slide valve in line with the service port in the connection block, allowing fluid to pass to the pump motor. Fluid displaced by the larger piston to the manifold returns through the open return seat of the ball valve.

R R R R R R R The restrictor bobbin (damper type) and another restrictor bobbin are fitted to slow down the slide movement when the solenoid is energized. This prevents the rapid opening of the main supply to the pump motor during selection. The non-return valve bobbin allows free flow out of the small piston chamber during selection, when the solenoid is de-energized, to prevent over-pressurization.

7. Inlet Valve

The six inlet valve units are identical, each comprising a valve element mounted in an isolation canister. Each element consists of two separately controlled electric motors (one a standby), driving through a differential epicylic gear

train, and a spherical plug valve. The description of the valve unit components is the same as that given for the LP isolation valve (Ref. 28-21-00).

Two of the inlet valves are installed in the trim pipe to control the flow of fuel into tank 9. The valve canisters are mounted on the floor of tank 10 left and right cells. The two inlet valves for tank 11 are installed in the left and right trim transfer pipes in the rear fuselage on frame 88, their canisters being mounted on the fuselage structure. Two inlet valves, one for each of tanks 5 and 7, are installed near the outlet end of the trim transfer pipe in the respective tanks. The valve canisters are mounted on the floor of each tank.

8. Pump Pressure Switch

Warning of low pressure output from each transfer pump is given by a caption light on the system management panel operated by a fuel pressure switch. The switches for the forward trim pumps are mounted in the forward underwing fairing. Those for the rear transfer pumps are attached to the outside wall near the pumps (Ref. Fig. 005).

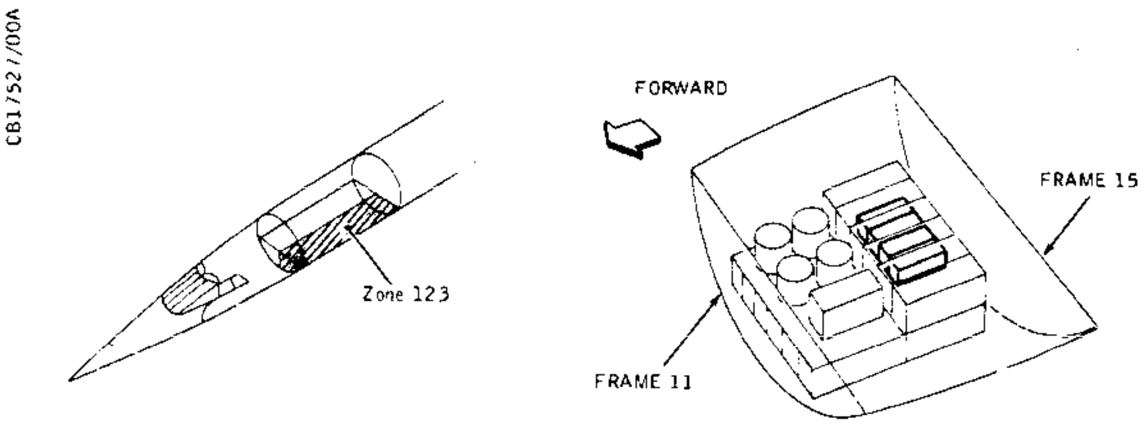
The description of the pressure switch components is the same as that given for the de-aeration pump pressure switch (Ref. 28-13-00).

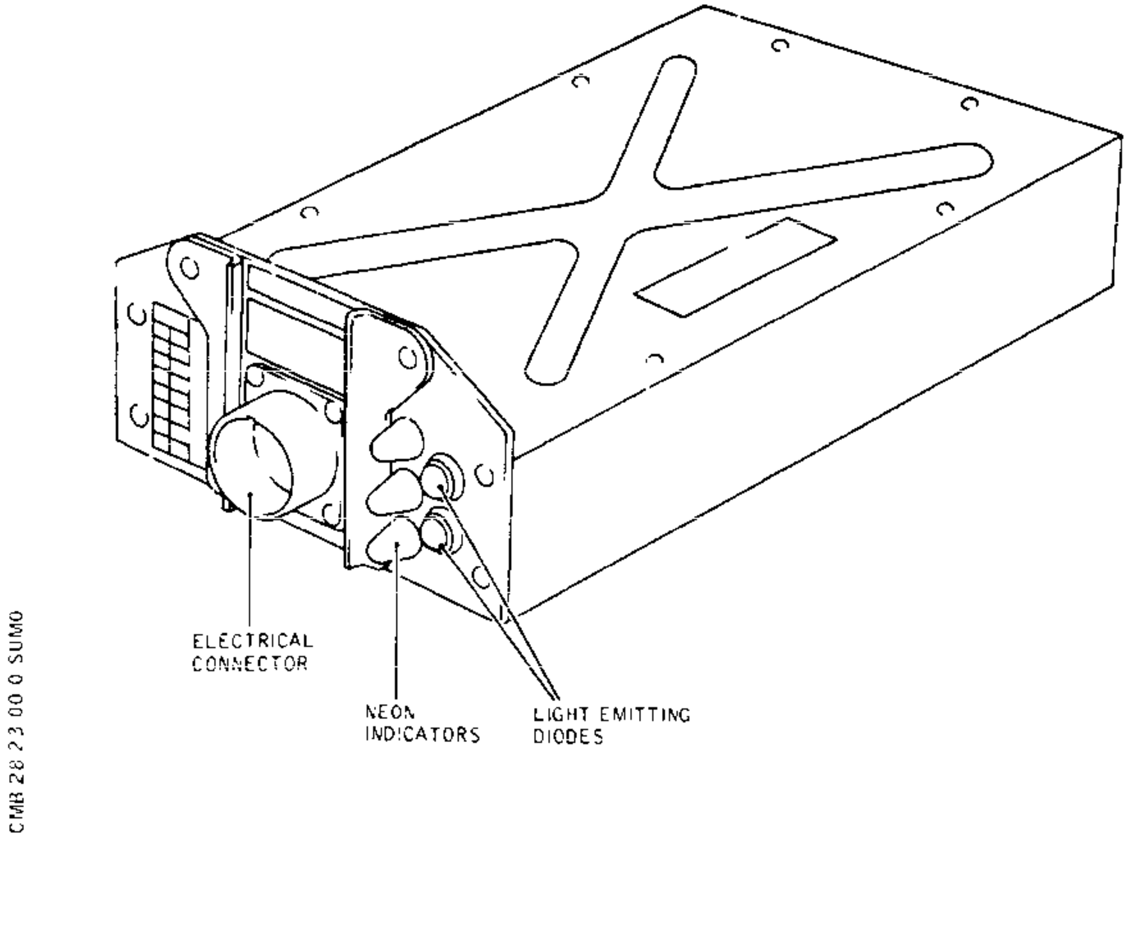
9. Pump Start Control Unit (Ref. Fig. 008)

The pump start control unit comprises a metal case that houses the electronic pulse start control circuits. The front panel of the unit houses the electrical connector and built-in test equipment (BITE) indicators. The indicators comprise three neon lamps, identified A, B and C, and two light-emitting diodes (LEDs), identified 5 and 6.

The unit is used to prevent transient high fuel pressure in the main trim transfer pipe, by controlling the average acceleration during starting of the trim pumps in tanks 9 and 10. The unit inhibits the pump contactor operation and controls the three-phase supply to linearly extend the pump starting period to approximately 5 s. After 5 s the unit causes the pump contactor to be energized and then terminates the starting cycle; the pump contactor then controls the running period of the pump.

The control units are attached to the rear of the top right aft panel in the forward underfloor racking in zone 123. The units are each secured by two screws and a spigot.





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Pump Start Control Unit
Figure 008

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10. Operation

A. Control and Indication (Ref. Fig. 009)

The control switches and indicators for the trim transfer system are located in flow form at the centre of the fuel management panel at the third crew member's station.

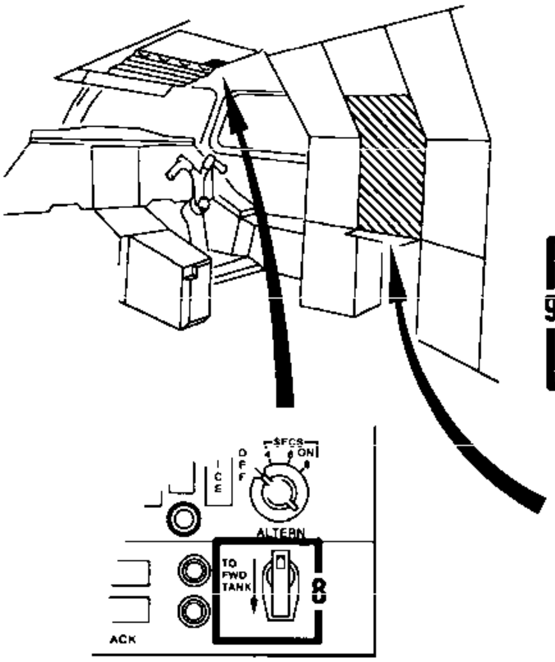
Each trim transfer pump is independently controlled by a PUMP (ON - AUTO - OFF) switch. An associated yellow LOW PRESS caption is illuminated to give warning of low fuel pressure delivery by pump. The caption has a dimming facility.

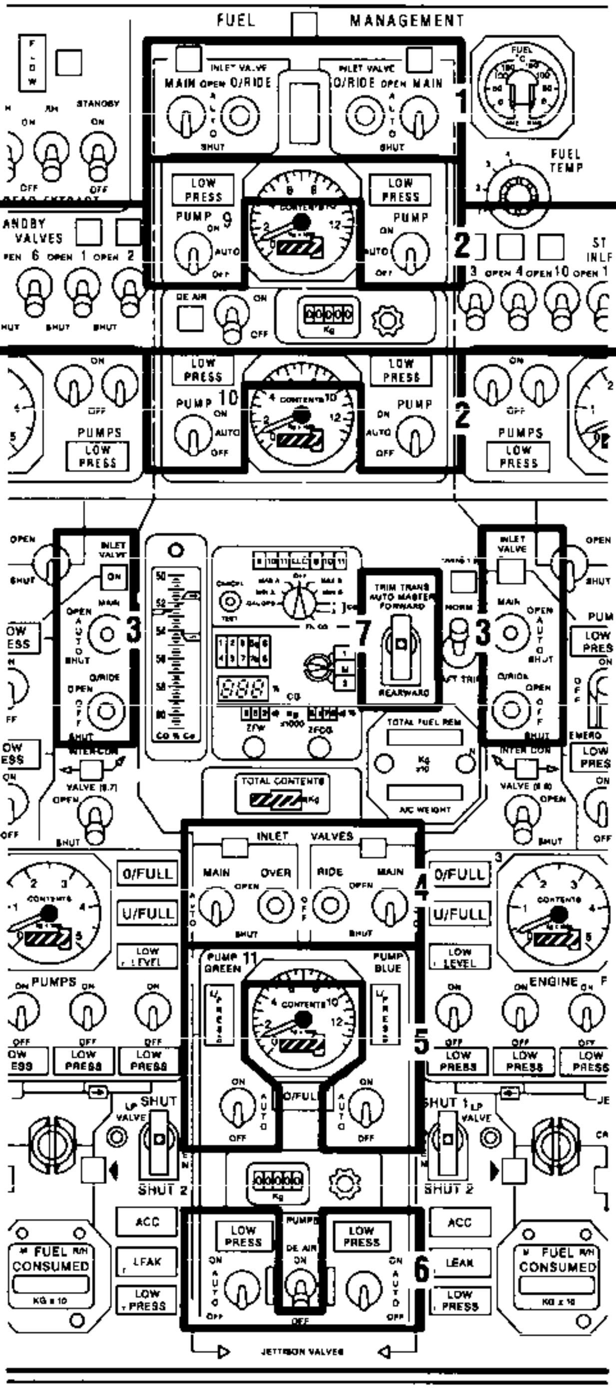
Each trim transfer inlet valve can be driven either by its normal or its standby motor. The normal motor is controlled either manually or automatically by a MAIN (OPEN - AUTO - SHUT) switch, provided that the associated standby motor O/RIDE (OPEN - OFF - SHUT) switch is set to OFF. This O/RIDE switch is locked in the OFF position and must be pulled out against spring tension before either OPEN or SHUT can be selected. Each valve has a three-position magnetic indicator which shows 'in-line' and 'cross-line' with the fuel flow line on the panel when the valve is open and shut respectively, and diagonal stripes either with the circuit de-energized or when the valve is in transit.

Certain refuelling valves, for tanks 1, 2, 3, 4, 5, 6, 7, 8 and 10 (Ref. 28-24-00), can also be used for in-flight trim transfer. These valves are controlled by STANDBY INLET VALVE switches which have OPEN and SHUT positions and are located on the fuel management panel. The switches are locked in both OPEN and SHUT positions and must be pulled out against spring tension before operation. Magnetic indicators are provided for tank valves 1, 2, 3, 4 and 10 only as these are the valves used for special trim operations. Each magnetic indicator shows OPEN or SHUT, according to the valve position, and diagonal stripes when the valve is in transit or the circuit is de-energized.

The TRIM TRANS AUTO MASTER switch is the guarded toggle type with FORWARD - OFF - REARWARD positions.

The FUEL FWD TRANS override switch is located on the pilots' roof panel and has two positions, one normal the other O/RIDE. The normal position permits the use of the auto master switch to initiate auto transfer through the auto trim relays, provided all appropriate switches are set for auto transfer. In similar





1 TANK 9 INLET VALVES CONTROL SWITCHES AND INDICATORS

2 TANKS 9 AND 10 TRIM PUMPS (ELECTRIC) CONTROL SWITCHES AND CAPTION LIGHTS

3 TANKS 5 AND 7 INLET VALVE CONTROL SWITCHES AND INDICATOR

4 TANK 11 INLET VALVES CONTROL SWITCHES AND INDICATORS

5 TANK 11 TRIM PUMPS (HYDRAULIC) CONTROL SWITCHES AND INDICATORS

6 TANK 11 TRIM PUMPS (ELECTRIC) CONTROL SWITCHES AND CAPTION LIGHTS

7 TRIM TRANSFER AUTO MASTER SWITCH

8 TRIM TRANSFER OVERRIDE SWITCH

9 STANDBY INLET VALVES SWITCHES AND INDICATORS

Trim Transfer Controls and Indicators
Figure 009

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circumstances when O/RIDE is selected the auto master switch and the load limit control and standby c.g. pack are bypassed and forward transfer is initiated through the override relay.

Caption filaments can be checked by depressing the LIGHT TEST push-switch, on the electrical services panel.

B. Functional Description (Ref. Fig. 010)

Normally automatic, trim transfer operations are initiated by the master control. The amount of fuel transferred is controlled by the load limit control section of the fuel quantity indication system (Ref. 28-44-00). In an emergency, any selection of the master control or load limit selection can be overridden and forward transfer initiated by setting the FUEL FWD TRANS override switch to O/RIDE.

The start of cruise transfer consists of transferring all the fuel out of the forward tanks 9 and 10, filling rear tank 11 to a predetermined quantity and putting the remaining fuel into main tanks 5 and 7.

The end of cruise transfer consists of transferring all the fuel out of rear tank 11, putting a predetermined quantity into forward tank 9 and the remaining fuel into main tanks 5 and 7. The fuel in tank 9 is part of the reserve fuel and may be transferred to the main tanks if required.

In the event of an emergency deceleration, fuel is transferred from tank 11 to tank 9. This transfer is always sufficient to move the c.g. and trim the aircraft for subsonic speeds.

The whole or any part of the transfer operation can be carried out either by preset automatic or by manual control.

C. Inlet Valve Control (Ref. Fig. 011)

The twin motors of each trim inlet valve are controlled independently by a MAIN switch for the normal motor and an O/RIDE switch for the standby motor.

The OFF position of the O/RIDE switch places the inlet valve under the control of the MAIN switch. The OPEN and SHUT positions of the O/RIDE switch isolate the MAIN switch and directly control the standby motor.

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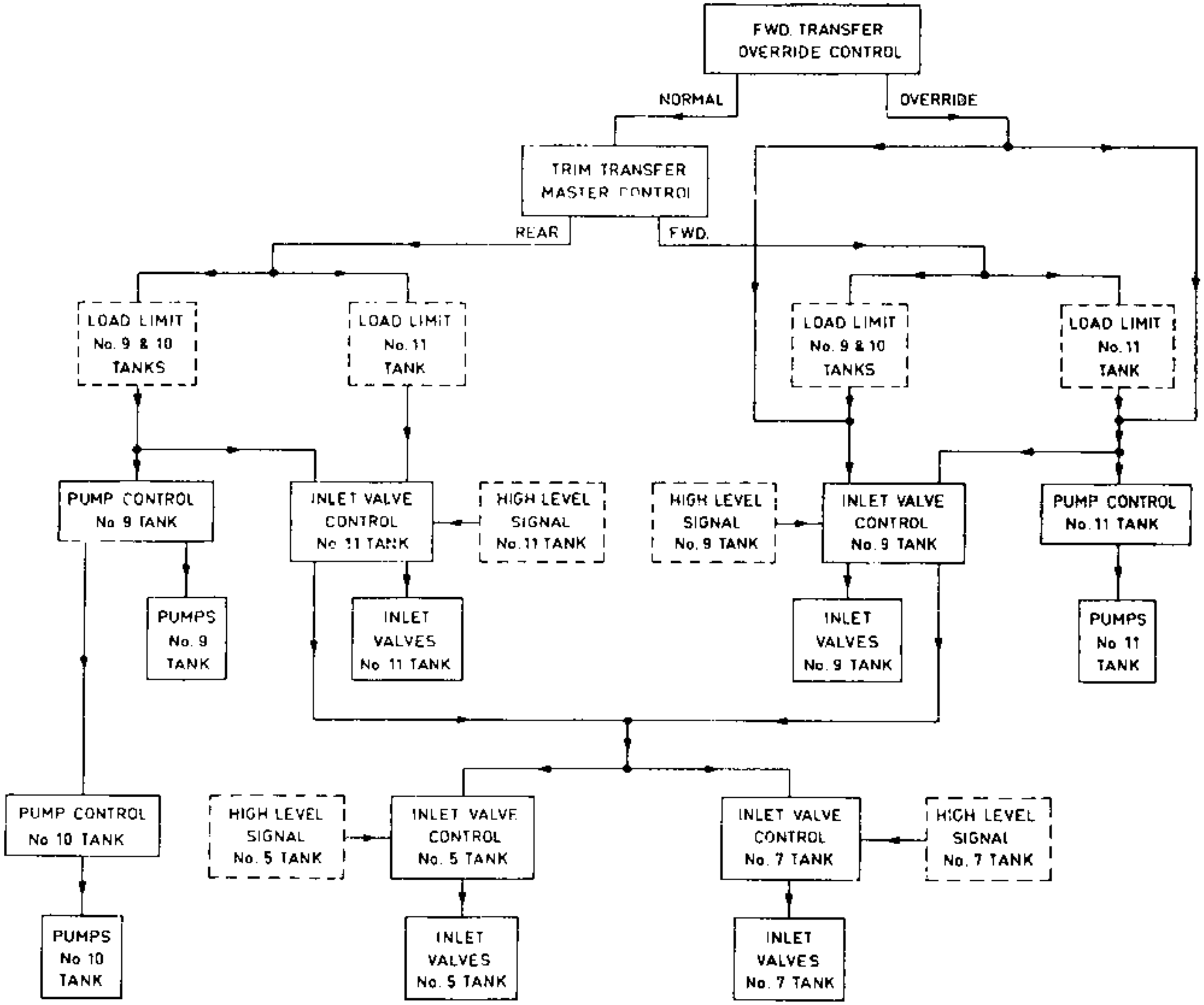

Trim Transfer - Block Diagram
Figure 010

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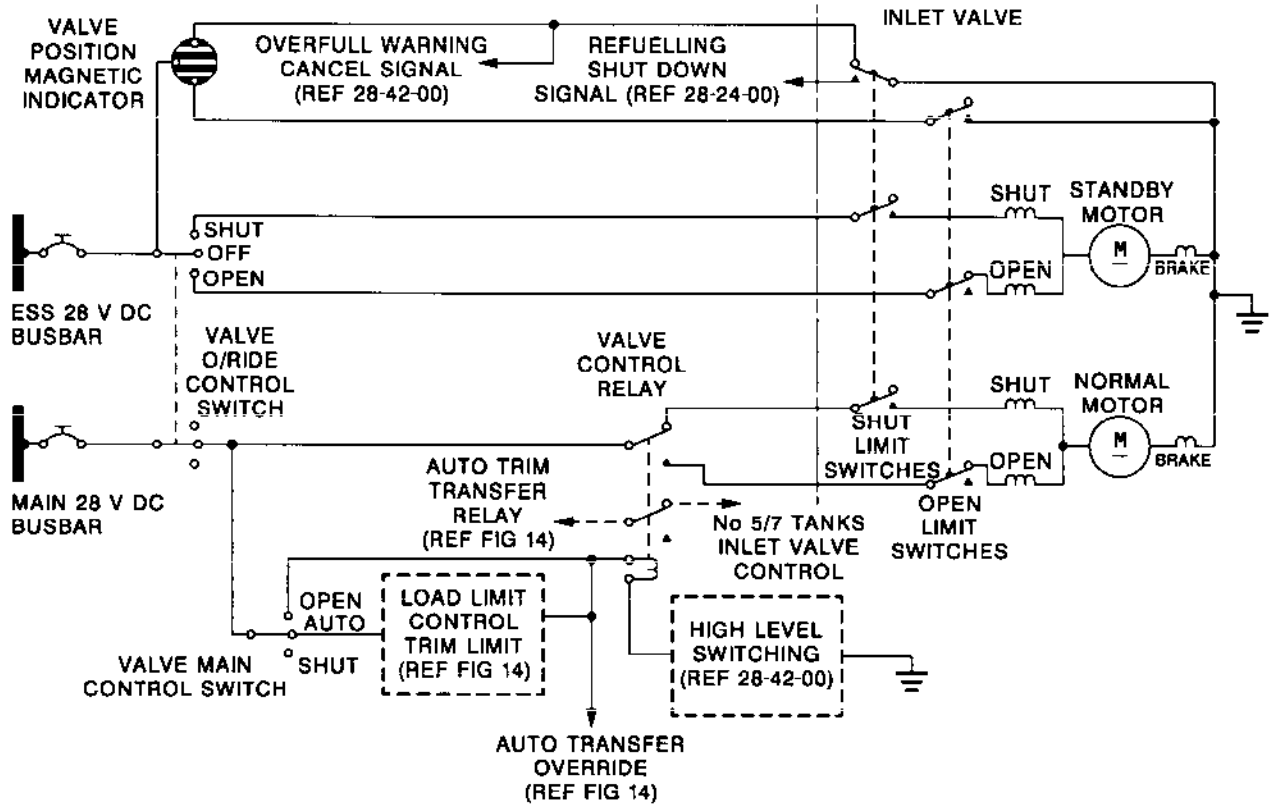
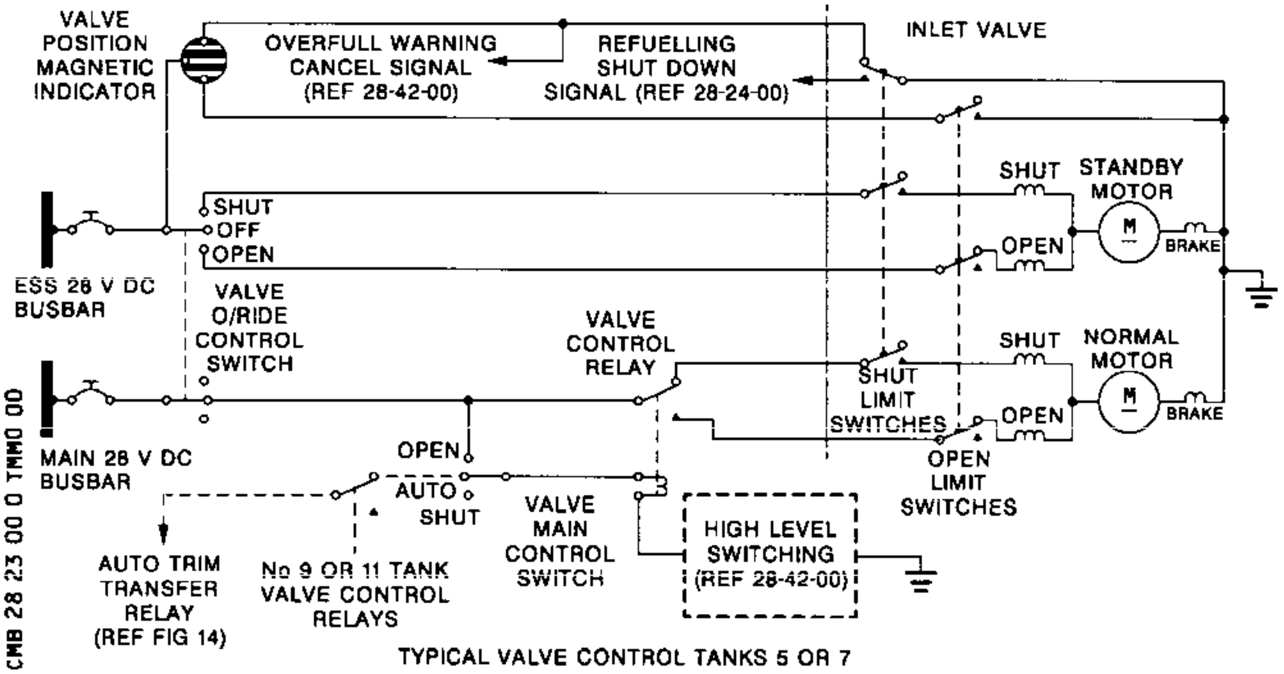


TYPICAL VALVE CONTROL TANKS 9 OR 11



TYPICAL VALVE CONTROL TANKS 5 OR 7

Inlet Valve Control - Simplified Schematic
Figure 011

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The electrical supply to the normal motor of each inlet valve is switched by a valve control relay. A control relay is automatically de-energized to shut the inlet valve if fuel within the tank reaches high level.

The OPEN and SHUT positions of the MAIN control switch directly energize or de-energize the valve control relay to open or shut the inlet valve by the normal motor. The AUTO position of the control switch brings the valve control relay under the control of the selected load limit. The inlet valves for tanks 5 and 7, when trim transfer pumps are running, are automatically opened via the associated valve control relays when both inlet valves, either of tank 9 or tank 11, shut due to a pre-selected load limit or a high level.

A 'shut' indication signal from each tank inlet valve is used to cancel any overfull level signal for the tank when the valve is closed.

D. Forward Pump Control (Ref. Fig. 012)

The pumps are switched on by the pump control switch, either directly when the switch is at ON, or, when the switch is at AUTO, via a pump control relay during automatic rearward transfer.

During the first 5 s of the pump starting period, the pump start control unit inhibits the pump contactor operation and controls the three-phase supply to linearly extend the starting period.

A pulsed-driver circuit supplies electrical power in a pulsed train that has a mark-space ratio which changes from 5 % power on, 95 % power off, on the initial pulse, to 100 % power on after 5 s.

After 5 s, the 5 s timer causes the pump contactor coil to be energized. An auxiliary contact in the pump contactor then provides a lock-on function for the pump contactor, thereafter during the pump running period the pump is contactor-controlled.

The 6 s timer inhibits the pulsed-driver circuit and will also cause the pump contactor coil to be energized if the 5 s timer has not operated.

Indicators on the front panel of the control unit comprise three neon lamps and two light-emitting diodes (LEDs). The neon lamps, identified A, B and C, are lit when aircraft electrical power is on. When the pump is first switched

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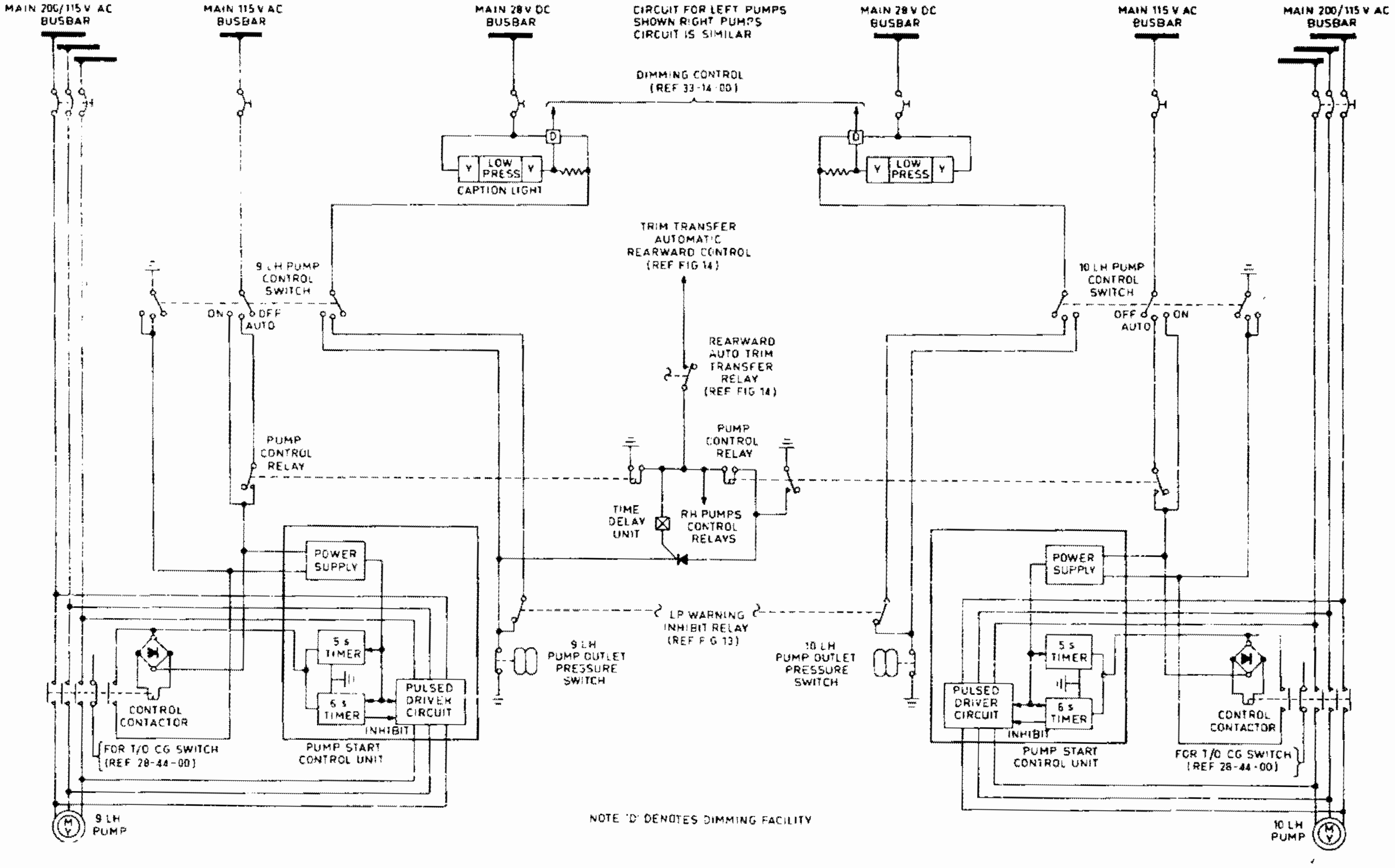


Forward Pump Control - Simplified Schematic
Figure 012

on, the lights will gradually dim until at the end of the 5 s period they are extinguished. The LEDs, identified 5 and 6, become illuminated respectively at the end of the 5 s and 6 s periods of the starting cycle.

The control unit is protected against overheating by thermal fuses, and is rated for not more than five starts in the first 5 min of any 15 min period.

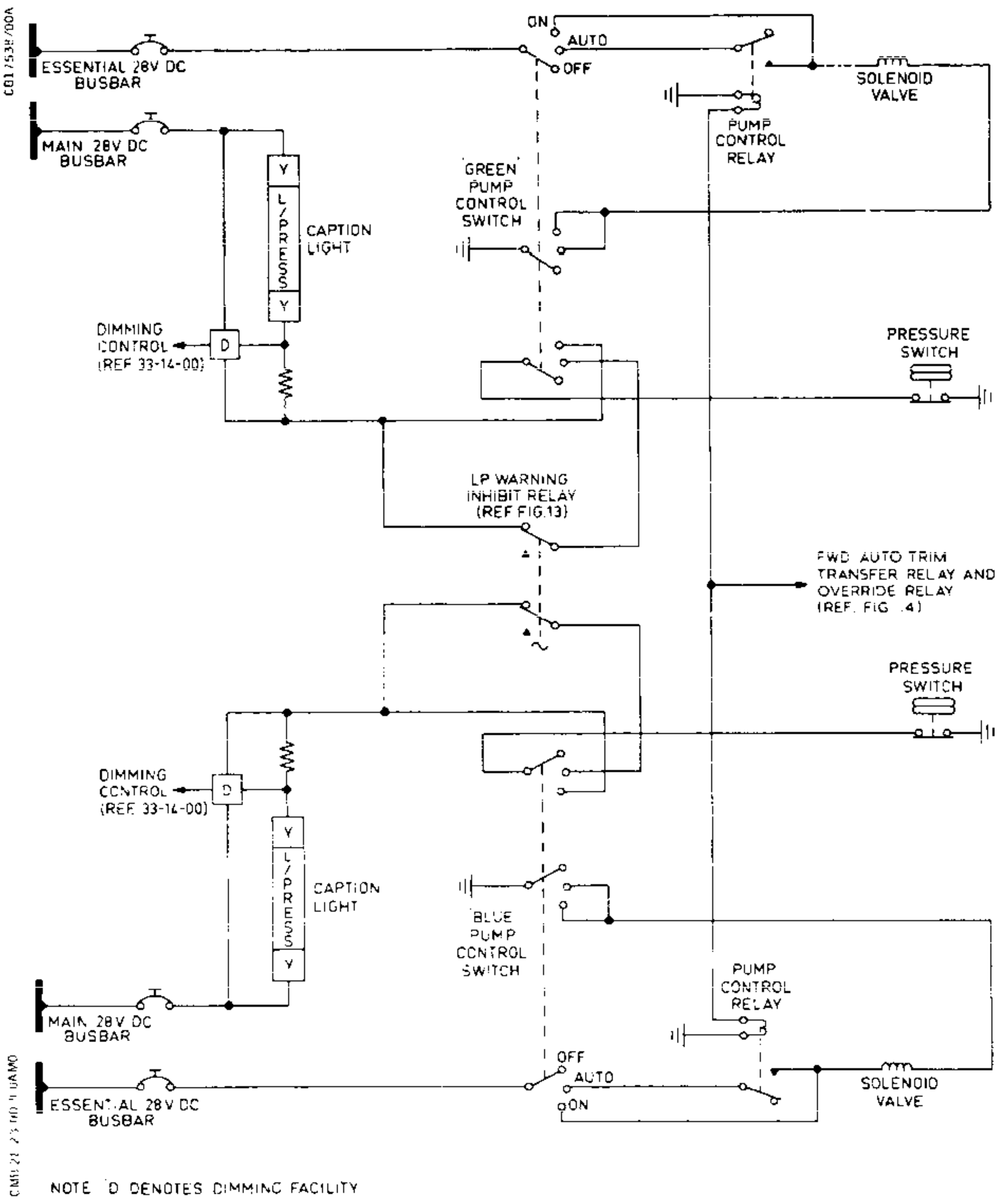
During a rearward trim transfer operation the pumps in tank 9 commence operating immediately, but the pumps in tank 10 are 'held-off' until low pressure is sensed by tank 9 pressure switches, i.e., tank empty. Time delay units are incorporated which prevent tank 10 pumps from operating until a predetermined time after tank 9 pumps low pressure is indicated. The pumps in both tanks switch off by operation of the load level control switch for tank 10.

A magnetically latched T/O CG switch (Ref. 28-44-00) is energized, via auxiliary contacts of tanks 9 and 10 pumps contactors, when the switch is set to 54 % and tanks 9 and 10 pumps are switched off. The latching supply is controlled via pumps 9 LH and 10 LH contactors and pumps 9 RH and 10 RH contactors in a series-parallel configuration. Because the pump start control units impose a 5 s time delay on the energizing of tanks 9 and 10 pump contactors, there will be a time delay of 5 s after the pumps are switched on before the T/O CG switch resets to NORM.

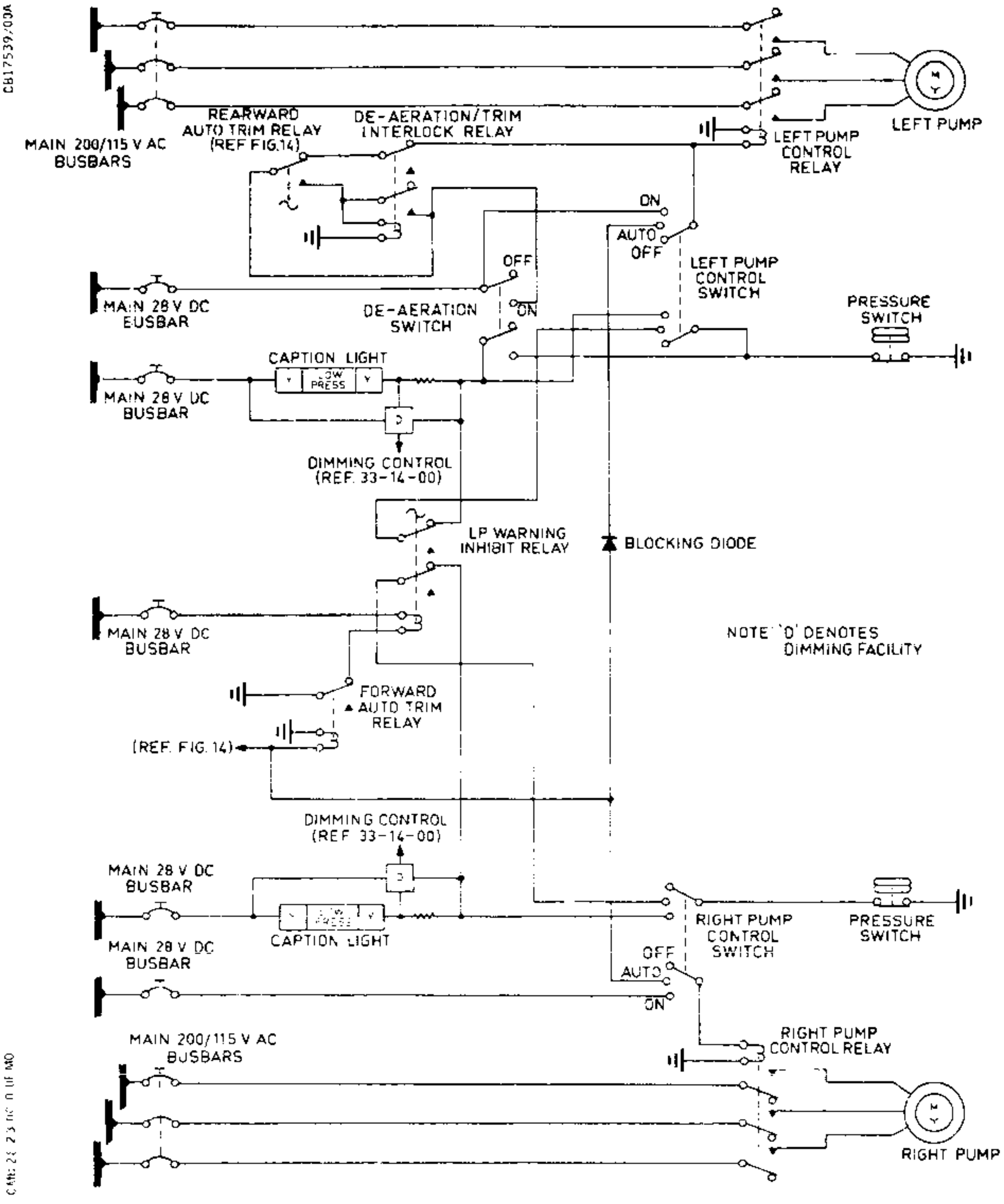
E. Rear Pump Control (Ref. Fig.013 and 014)

The solenoids of the electro-hydraulic selector valves for the green and blue hydraulic pumps are independently controlled, either directly from the ON position of the pump control switch or from the AUTO position of the switch, via a pump control relay, during a forward trim transfer operation.

The left and right electric pump control switches, engraved ON - AUTO - OFF, control the corresponding pumps, directly in the ON position and via the auto trim transfer and override relays in the AUTO position. A yellow LOW PRESS caption is illuminated to give warning of low fuel pressure delivery by the associated pump when the switch is at ON or AUTO. A de-aeration switch, together with the rearward auto trim and de-aeration/trim interlock relays, permits the left-hand electric pump to be used for de-aeration. The de-aeration/trim interlock relay prevents the pump being used for



Rear Pump (Hydraulic) Control -
Simplified Schematic
Figure 013



- Rear Pump (Electric) Control -
Simplified Schematic
Figure 014

de-aeration when rear trim transfer is taking place.

The forward auto trim relay controls the LP warning inhibit relay to prevent LP warning when forward trim transfer is in progress.

F. Automatic Master Control (Ref. Fig. 015)

NOTE: All appropriate valve and pump control normal switches must be set to AUTO and override switches to OFF, for automatic operation.

With the trim transfer auto master switch set to FORWARD, the tank 11 pumps are controlled via tank 11 load limit control and the forward auto trim transfer relay. Tank 9 inlet valves are controlled via tanks 9 and 10 load limit control.

With the trim transfer auto master switch set to REARWARD the tanks 9 and 10 pumps (in sequence) are controlled via tanks 9 and 10 load limit control and the rearward auto trim transfer relay. Tank 11 inlet valves are controlled via tank 11 load limit control.

The inlet valves for tanks 5 and 7 are automatically brought under the control of an auto trim transfer relay when both inlet valves in a trim tank close during an automatic transfer. The supply to tanks 5 and 7 inlet valves is completed via the two inlet valve control relays, either of tank 9 or tank 11, when both relays become de-energized due to preselected load limit being reached or the fuel in the associated tank reaching high level.

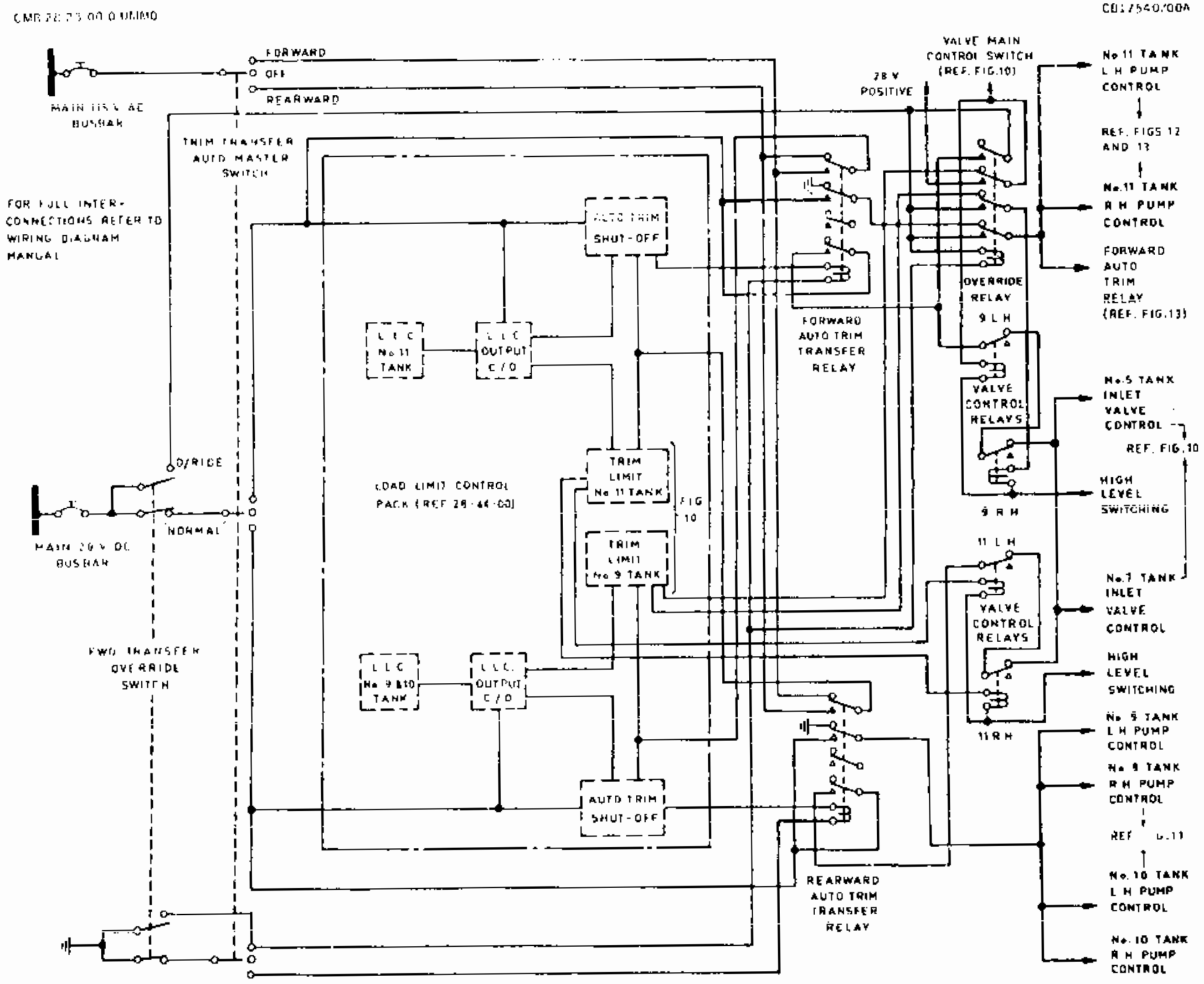
G. Override Control (Ref. Fig. 015)

The O/RIDE position of the forward transfer override switch isolates the supply to the master switch and directly energizes the override relay to run the pumps in tank 11 and, irrespective of any preselected load limit, opens the tank 9 inlet valve.

H. Manual Control

NOTE: For transferring fuel on the ground reference should be made to 28-00-00, 'Servicing - Fuel Transfer on the Ground'.

With the TRIM TRANS AUTO MASTER switch at off (centre position and guarded) the pumps and valves can be operated



- Automatic Master Control - Simplified Schematic
Figure 015

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manually by setting the PUMPS switches to ON or OFF, the MAIN inlet valve switches to OPEN or SHUT, the OVERRIDE switches to OPEN or SHUT and the STANDBY INLET VALVES switches to OPEN or SHUT. Except when they are under the control of the OVERRIDE switches, the valves will automatically close if the fuel in the associated tank reaches 'high' level.

11. Electrical Power Supplies

Electrical power supplies for inlet valves, pumps and automatic transfer control are detailed in Table 1.

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
INLET VALVE		
Tank 9 LH		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213
Tank 9 RH		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213
Tank 11 LH		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213
Tank 11 RH		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213
Tank 5		
Normal supply and control	'A' main 28 V d.c.	15-215
Standby supply, control and indication	'B' essential 28 V d.c.	3-213

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Tank 7		
Normal supply and control	'B' main 28 V d.c.	15-216
Standby supply, control and indication	'A' essential 28 V d.c.	1-213
AUTOMATIC SYSTEM		
Automatic trim transfer control	'B' main 28 V d.c.	15-216
Automatic trim transfer supply	No.3 main 115 V a.c.	13-216
PUMP		
Tank 9 LH		
Supply	No.1 main 115/200 V a.c.	14-215
Control	No.1 main 115 V a.c.	14-215
Indication	'A' main 28 V d.c.	15-215
Tank 9 RH		
Supply	No.3 main 115/200 V a.c.	13-216
Control	No.3 main 115 V a.c.	13-216
Indication	'B' main 28 V d.c.	15-216
Tank 10 LH		
Supply	No.4 main 115/200 V a.c.	14-216
Control	No.4 main 115 V a.c.	14-216
Indication	'B' main 28 V d.c.	15-216
Tank 10 RH		
Supply	No.2 main 115/200 V a.c.	13-215
Control	No.2 main 115 V a.c.	13-215
Indication	'A' main 28 V d.c.	15-215
Tank 11 green		
Supply and control	'A' essential 28 V d.c.	1-213
Indication	'B' main 28 V d.c.	15-216
Tank 11 blue		
Supply and control	'B' essential 28 V d.c.	3-213
Indication	'A' main 28 V d.c.	15-215

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Tank 11 (electric) LH		
Supply	No.3 main 115/200 V a.c.	13-216
Control	'B' main 28 V d.c.	15-216
Indication	'A' main 28 V d.c.	15-215
Tank 11 (electric) RH		
Supply	No.2 main 115/200 V a.c.	13-215
Control	'A' main 28 V d.c.	15-215
Indication	'B' main 28 V d.c.	15-216
Tanks 9, 10 and 11 LP warning inhibit	'B' main 28 V d.c.	15-216

Electrical Power Supplies
Table 1

TRIM TRANSFER SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4., 5. and 6.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of group service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

The basic principle of the procedures is that the manual selection and operation of the components are checked first, followed by a test of the automatic control system.

The procedures are grouped, for convenience of application, under the following headings. Under the first two headings the items covered are listed, in the order in which they are dealt with.

Trim Inlet Valves (Ref. para.3.)

Override switching.

Main control switching.

Trim Pumps (Ref. para.4.)

Electrically driven pumps.

Tank 11 hydraulically driven pumps.

Auto Trim Transfer (Ref. para.5.)

Load Limit Control, Zero Locking Inhibition (Ref. para.6.)

Where circuits for trim/valves or trim pumps are similar and incorporate identical components, e.g., Control Switches, Trim Valves or Trim Pumps, all references to the associated components listed in Table 101 are given, e.g. 'Renew Inlet Valve (102), (103), (106), (107), (104) or (105)', or 'Renew Fuel Pump (48), (49), (50), (51), (68) or (69)'.

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Break-out board and plug, for test connections on Standby CG Pack plug P3	Local

B. Prepare

(1) Ensure that circuit breakers (Ref. Table 101) are set.

(2) Make available electrical ground power as detailed in 24-41-00.

R (3) For the requirements of paragraphs 4. and 5., set the fuel tank quantities as follows, refuelling (Ref. 12-11-28) or defuelling (Ref. 28-25-00) as required:-

(a) Tank 9 - 4,000 kg.

(b) Tank 10 - full.

(c) Tank 1 and 4 - full.

(d) Tank 11 - 1,000 kg.

(e) Remaining tanks - empty, i.e., at unusable level.

R (4) Display warning placards at the fuel management panel (3CM station) and the refuel control panel to indicate that work is being carried out on the fuel system.

R (5) When trouble shooting the automatic transfer control system (Ref. para.5.), ensure, by reference to the aircraft attitude indicator (Ref. 12-11-10, Refuelling - Associated Operations), that the bubble is within the nominal ground attitude envelope.

R (6) Ensure that the fuel quantity indication (FQI) system (Ref. 28-44-00) is serviceable.

R (7) At the lower electrical services panel, 6.214, press LIGHTS CTR switch to "TEST". Check that LOW PRESS captions are illuminated.

3. Trouble Shooting - Trim Inlet Valves

NOTE: This test checks the manual selection and operation of the trim inlet valves by their O/RIDE and MAIN control switches, in the following order:-

O/RIDE - Tank 9 LH,
Tank 9 RH,
Tank 5,
Tank 7,
Tank 11 LH,
Tank 11 RH.

MAIN - Tank 9 LH,
Tank 9 RH,
Tank 5,
Tank 7,
Tank 11 LH,
Tank 11 RH.

The STANDBY INLET VALVES for tanks 5, 6, 1, 2, 3, 4, 10, 7 and 8 are covered in 28-24-00, Trouble Shooting.

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).  *
  *With the switches and valves' associated  *
  *indicators set as detailed in 28-00-00,   *
  *Servicing; check that the mechanical      *
  *indicator at Valves (102), (103), (106),  *
  *(107), (104), and (105) are at SHUT.      *
  *******************************************
            |
B.*******************************************
  *Set O/RIDE control switch to "OPEN". Check*
  *that magnetic indicator display changes   *
  *to diagonal stripes and then to bar-in-   *
  *line within 1.5 to 2 s; check that        *
  *mechanical indicator at valve is at OPEN. *
  *Set switch to "SHUT". Check that magnetic *
  *indicator display changes to diagonal     *
  *stripes and then to bar-across-line within*
  *1.5 to 2 s; and check that mechanical     *
  *indicator at valve is at SHUT.  IF -      *
  *******************************************
            |    |
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              |    |
              |    |         ------------------------------------
              |    |        |1. Trim valve does not operate and |
              OK   NOT OK------|   magnetic indicator displays      |
              |             |   diagonal stripes - check for     |
              |             |   28 V d.c. output from            |
              |             |   associated CB (24), (22), (29),  |
              |             |   (26), (33) or (30). Renew as     |
              |             |   necessary.                       |
              |             |2. Trim valve does not open/close  |
              |             |   when O/RIDE control switch       |
              |             |   operated - Chart 101.            |
              |             |3. Trim valve magnetic indicator   |
              |             |   faulty with correct valve        |
              |             |   operation - Chart 102.           |
              |              ------------------------------------
              |
C.********************************************
  *Reset O/RIDE switch to "OFF".             *
  ********************************************
              |
D.********************************************
  *Set MAIN control switch to "OPEN". Check  *
  *that magnetic indicator display changes to*
  *diagonal stripes and then to bar-in-line  *
  *within 1.5 to 2 s; check that mechanical  *
  *indicator at valve is at OPEN.  Set switch*
  *to "SHUT".  Check that magnetic           *
  *indicator display changes to diagonal     *
  *stripes and then to bar-across-line within*
  *1.5 to 2 s; check that mechanical         *
  *indicator at valve is at SHUT. IF -       *
  ********************************************
              |    |
              |    |         ------------------------------------
              |    |        |Trim valve does not open/close when|
              OK   NOT OK------|MAIN control switch operated -     |
              |             |Chart 103.                         |
              |              ------------------------------------
              |
E.********************************************
  *Reset MAIN switch to "AUTO".              *
  ********************************************
```

4. Trouble Shooting - Trim Pumps

NOTE: This test checks the manual selection and operation of the trim pumps, under the following paragraphs:-

Paragraphs A. to C.:	Tank 9 LH, then RH. Tank 10 LH, then RH. Tank 11 LH, then RH.
Paragraphs D. to E.:	Tank 11 GREEN, then BLUE.
Paragraphs F. to J.:	The operation and isolation of tank 11 LH pump in the DE-AIR mode.
R Paragraphs K. to P.:	The interaction of tanks 9 and 10 pumps contactors with the 'T/O CG' switch on panel 1-214.

A. *Prepare to trouble shoot (Ref. para.2.). With trim pump control switches at AUTO and Trim Transfer Auto Master Switch (109) at OFF, check that all pump LOW PRESS captions are extinguished. IF -

- OK
- NOT OK ------ Trim pump LOW PRESS captions are illuminated when control switches are at AUTO and auto master switch is at OFF - Chart 104.

R **ON A/C 001-005,

B. **CAUTION:** TO LESSEN PRESSURE SURGES THE TRIM PUMPS IN TANKS 9 AND 10 MUST NOT BE SWITCHED 'ON' UNTIL AN ASSOCIATED LH AND/OR RH STANDBY INLET VALVE IS OPENED. WHEN TRIM PUMPS ARE SWITCHED 'OFF', CLOSE THE ASSOCIATED STANDBY INLET VALVE.

R After SB 28-048: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

Set pump control switch to "ON". Check that pump is heard to run and LOW PRESS caption is illuminated and then extinguished within 3 s. Set control switch to "OFF"; check that pump is heard to stop running and LOW PRESS caption is not illuminated. IF -

OK

NOT OK ======

1. Trim pump runs but LOW PRESS caption is not illuminated when pump switched on - Chart 105.
2. Trim pump runs but LOW PRESS caption is not extinguished after 3 s when pump switched on- renew Pressure Switch (52),(53),(54),(55),(72) or (73). If fault not cleared, check pressure switch sense pipe and/or trim pump filter screen for blockage.
3. Trim pump does not run and LOW PRESS caption remains illuminated when pump switched ON - Chart 106 or 106A.

After SB 28-048

4. LOW PRESS caption is illuminated for 5 to 6 s and is then extinguished - renew Pump Start Control Unit (135), (136), (137) or (138).

R **ON A/C 006-007,

B.***

CAUTION: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

Set pump control switch to "ON". Check that pump is heard to run and LOW PRESS caption is illuminated and then extinguished within 3 s. Set control switch to "OFF"; check that pump is heard to stop running and LOW PRESS caption is not illuminated. IF-

****

OK

NOT OK

1. Trim pump runs but LOW PRESS caption is not illuminated when pump switched on - Chart 105.
2. Trim pump runs but LOW PRESS caption is not extinguished after 3 s when pump switched on- renew Pressure Switch (52),(53),(54),(55),(72) or (73). If fault not cleared, check pressure switch sense pipe and/or trim pump filter screen for blockage.
3. LOW PRESS caption is illuminated for 5 to 6 s and is then extinguished - renew Pump Start Control Unit (135), (136), (137) or (138).
4. Trim pump does not run and LOW PRESS caption remains illuminated when pump switched ON - Chart 106.

```
               |
C.*********************************************
  *Reset pump control switch to "AUTO".      *
  *********************************************
               |
D.*********************************************
  *NOTE:  The following operation checks the  *
  *       hydraulically driven GREEN and BLUE *
  *       pumps for tank 11.                  *
  *Using the ground pressurizing system       *
  *(Ref. 29-23-00), pressurize the appropriate*
  *hydraulic system (LH pump - green system,  *
  *RH pump - blue system).  Set pump control  *
  *switch to "ON". Check that pump is heard   *
  *to run and LOW PRESS caption is illumi-    *
  *nated and then extinguished within 3 s.    *
  *Set control switch to "OFF". Check that    *
  *pump is heard to stop running and LOW      *
  *PRESS caption is not illuminated.  IF -    *
  *********************************************
               |    |
               |    |      -----------------------------------
               |    |     |1. Trim pump runs but LOW PRESS    |
              OK   NOT OK-|   caption is not illuminated when |
               |          |   pump switched ON - Chart 107.   |
               |          |2. Trim pump runs but LOW PRESS    |
               |          |   caption is not extinguished     |
               |          |   after 3 s when pump switched    |
               |          |   ON - renew Pressure Switch      |
               |          |   (74) or (75). If fault not      |
               |          |   cleared, check pressure switch  |
               |          |   sense pipe and/or trim pump     |
               |          |   filter screen for blockage.     |
               |          |3. Trim pump does not run and LOW  |
               |          |   PRESS caption remains illumi-   |
               |          |   nated when pump switched ON -   |
               |          |   Chart 108.                      |
               |           -----------------------------------
               |
E.*********************************************
  *Reset pump control switch to "AUTO" and    *
  *switch off the ground pressurizing system  *
  *(Ref. 29-23-00).                           *
  *********************************************
               |
```

F. NOTE: The following operation checks the operation and isolation of tank 11 LH electrical pump in the DE-AIR mode.
Set the DE-AIR switch to "ON". Check that the pump is heard to run and LOW PRESS caption is illuminated and then extinguished within 3 s IF -

OK

NOT OK

1. Tank 11 LH pump runs but LOW PRESS caption is not illuminated /extinguished when de-air switch at ON - check associated wiring for continuity and renew Control Switch (120).
2. Tank 11 LH pump does not run and LOW PRESS caption is illuminated when DE-AIR switch set to ON - Chart 109.

G. Set Tanks 9 and 10 Load Limit Control Selector (110) to 200 kg less than the combined contents of tanks 9 and 10 F.Q.I. (fuel quantity indication). Set tank 11 Load Limit Control Selector (111) to 200 kg more than the contents of tank 11.
Set the TRIM TRANS AUTO MASTER switch to "REARWARD" for 10 s only and then set the switch to "OFF".
NOTE: Disregard any operation of other pumps and valves except for tank 11 LH pump.
Check that tank 11 LH pump is heard to stop running and the LOW PRESS caption is illuminated when control switch is set to REARWARD. IF -

```
                 |     |
                 |     |          ------------------------------------
                 OK    NOT OK------|Tank 11 LH pump (DE-AIR does not   |
                 |                 |stop running when 'trim trans auto |
                 |                 |master switch' set to REARWARD -   |
                 |                 |Chart 110.                         |
                 |                  ------------------------------------
                 |
   H.*******************************************
     *After the 10 s period, check that tank 11 *
     *pump does not run and LOW PRESS caption   *
     *remains illuminated.  IF -                *
     *******************************************
                 |     |
                 |     |          ------------------------------------
                 |     |           |Tank 11 LH pump (DE-AIR) runs when |
                 OK    NOT OK------|'trim trans auto master' switch    |
                 |                 |reset to 'OFF' - check associated  |
                 |                 |wiring for continuity and renew    |
                 |                 |Trim/De-air Interlock Relay (121). |
                 |                  ------------------------------------
                 |
                 |
   I.*******************************************
     *Set the DE-AIR switch to "OFF"; check that*
     *LOW PRESS caption is extinguished. Set    *
     *load limit selectors to 0 kg.             *
     *******************************************

                 |
   J.*******************************************
     *At panel 1-214 set T/O CG switch to "54%".*
     *Check that switch 'latches' in this       *
     *position.  IF -                           *
     *******************************************
                 |

R  **ON A/C  001-005,
                 |     |
                 |     |          ------------------------------------
                 |     |           |Switch does not 'latch' at "54 %"  |
                 OK    NOT OK------|position - trouble shoot electrical|
                 |                 |supplies and switch (Ref. 28-44-00,|
                 |                 |Trouble Shooting).                 |
                 |                  ------------------------------------
```

```
                |
K.*******************************************
  *Follow the switching sequence: tank 9 LH, *
  *tank 9 RH, tank 10 LH, tank 10 RH. If the *
  *T/O CG switch resets to NORM during the   *
  *test, note which switch caused this effect*
  *and  reset the pump switch to "AUTO" and  *
  *the T/O CG switch to "54 %". Then continue*
  *the switching sequence.                   *
  *CAUTION:  TO LESSEN PRESSURE SURGES THE   *
  *          TRIM PUMPS IN TANKS 9 AND 10    *
  *          MUST NOT BE SWITCHED 'ON' UNTIL *
  *          AN ASSOCIATED LH AND/OR RH      *
  *          STANDBY INLET VALVE IS OPENED.  *
  *          WHEN TRIM PUMPS ARE SWITCHED    *
  *          'OFF', CLOSE THE ASSOCIATED     *
  *          STANDBY INLET VALVE.            *
  *                                          *
  *          After SB 28-048: A TRIM PUMP    *
  *          MUST NOT BE OPERATED MORE THAN  *
  *          5 TIMES IN THE FIRST 5 min OF   *
  *          ANY 15 min PERIOD.              *
  *Individually set tanks 9 and 10 LH and RH *
  *pump switches to "ON" and then to "AUTO". *
  *Check for no effect at the T/O CG switch. *
  *                                          *
  *After SB 28-048: Individually set tanks 9 *
  *and 10 LH and RH pump switches to "ON" for*
  *10 s and then to "AUTO". Check for no     *
  *effect at the T/O CG switch.  IF -        *
  *******************************************
                |    |
                |    |                 -----------------------------------
                |    |                |T/O CG switch  resets to NORM when |
               OK   NOT OK------------|a single tank 9 or 10 pump switched|
                |                     |ON - Chart 111.                    |
                |                      -----------------------------------
                |
                |
L.********************************************
  *Set tank 9 LH and RH pump switches to "ON".*
  *Check that T/O CG switch resets to NORM.   *
  *                                           *
  *After SB 28-048: Set tank 9 LH and RH pump *
  *switches to "ON". Check that after 5 s the *
  *T/O CG switch resets to NORM.  IF -        *
  ********************************************
                |    |
```

```
                 |    |         ------------------------------------
                 |    |        |T/O CG switch does not reset to     |
                OK   NOT OK------|NORM when tank 9 LH and RH pumps  |
                 |             |switched ON - Chart 112.            |
                 |              ------------------------------------
                 |
                 |
M.********************************************
   *Set tank 9 LH and RH pump switches to     *
   *"AUTO". Set T/O CG switch to "54 %". Set  *
   *tank 9 LH, then tank 10 RH, pump switch   *
   *to "ON". Check that T/O CG switch resets  *
   *to NORM.                                  *
   *                                          *
   *After SB 28-048: Set tank 9 LH and RH pump*
   *switches to "AUTO". Set T/O CG switch to  *
   *"54 %". Set tank 9 LH, then tank 10 RH,   *
   *pump switch to "ON". Check that after 5 s *
   *the T/O CG switch resets to NORM.  IF -   *
   ********************************************
                 |    |
                 |    |         ------------------------------------
                 |    |        |T/O switch does not reset to NORM -|
                OK   NOT OK------|renew Pump Control Contactor (47). |
                 |              ------------------------------------
                 |
N.********************************************
   *Reset pump switches to "AUTO". Reset T/O  *
   *CG switch to "54 %".  Set tank 9 RH, then *
   *tank 10 LH, pump switch to "ON". Check    *
   *that T/O CG switch resets to NORM.        *
   *                                          *
   *After SB 28-048: Reset pump switches to   *
   *"AUTO". Reset T/O CG switch to "54 %". Set*
   *tank 9 RH, then tank 10 LH, pump switch to*
   *"ON". Check that after 5 s the T/O CG     *
   *switch resets to NORM.  IF -              *
   ********************************************
                 |    |
                 |    |
                 |    |         ------------------------------------
                 |    |        |T/O CG switch does not reset to     |
                OK   NOT OK------|NORM - renew Pump Control Contactor|
                 |             |(46).                               |
                 |              ------------------------------------
                 |
O.********************************************
   *Reset pump switches to "AUTO".            *
   ********************************************
```

```
R  **ON A/C  006-007,
                |    |
                |    |     ----------------------------------
                |    |    |Switch does not 'latch' at "54 %"  |
               OK   NOT OK------|position - trouble shoot electrical|
                |         |supplies and switch (Ref. 28-44-00,|
                |         |Trouble Shooting).                 |
                |          ----------------------------------
```

```
                |
K.********************************************
  *Follow the switching sequence: tank 9 LH, *
  *tank 9 RH, tank 10 LH, tank 10 RH. If the *
  *T/O CG switch resets to NORM during the   *
  *test, note which switch caused this effect*
  *and  reset the pump switch to "AUTO" and  *
  *the T/O CG switch to "54 %". Then continue*
  *the switching sequence.                   *
  *CAUTION:  A TRIM PUMP MUST NOT BE OPERATED*
  *          MORE THAN 5 TIMES IN THE FIRST  *
  *          5 min OF ANY 15 min PERIOD.     *
  *Individually set tanks 9 and 10 LH and RH *
  *pump switches to "ON" for 10 s and then to*
  *"AUTO". Check for no effect at the T/O CG *
  *switch.  IF -                             *
  ********************************************
                |    |
                |    |         ------------------------------------
                |    |        |T/O CG switch  resets to NORM when |
               OK   NOT OK------|a single tank 9 or 10 pump switched|
                |             |ON - Chart 111.                    |
                |              ------------------------------------
                |
L.*********************************************
  *Set tank 9 LH and RH pump switches to "ON".*
  *Check that after 5 s the T/O CG switch     *
  *resets to NORM.  IF -                      *
  *********************************************
                |    |
                |    |         ------------------------------------
                |    |        |T/O CG switch does not reset to    |
               OK   NOT OK------|NORM when tank 9 LH and RH pumps   |
                |             |switched ON - Chart 112.           |
                |              ------------------------------------
                |
                |
M.********************************************
  *Set tank 9 LH and RH pump switches to     *
  *"AUTO". Set T/O CG switch to "54 %". Set  *
  *tank 9 LH, then tank 10 RH, pump switch   *
  *to "ON". Check that after 5 s the T/O CG  *
  *switch resets to NORM.  IF -              *
  ********************************************
                |    |
```

```
              |    |         ---------------------------------
              |    |        |T/O switch does not reset to NORM -|
              OK   NOT OK------|renew Pump Control Contactor (47). |
              |              ---------------------------------
              |
N.*******************************************
  *Reset pump switches to "AUTO". Reset T/O  *
  *CG switch to "54 %".  Set tank 9 RH, then *
  *tank 10 LH, pump switch to "ON". Check    *
  *that after 5 s the T/O CG switch resets   *
  *to NORM.  IF -                            *
  *******************************************
              |    |
              |    |         ---------------------------------
              |    |        |T/O CG switch does not reset to   |
              OK   NOT OK------|NORM - renew Pump Control Contactor|
              |             |(46).                              |
              |              ---------------------------------
              |
O.*******************************************
  *Reset pump switches to "AUTO".            *
  *******************************************
```

5. Trouble Shooting - Auto Trim Transfer

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).  *
  *Using the ground pressurizing system      *
  *(Ref. 29-23-00), pressurize the green and *
  *blue systems.  Ensure that the fuel tank  *
  *quantities are as detailed in paragraph 2.*
  *Set tanks 9 and 10 load limit selector to *
  *13,060 kg. Set tank 11 load limit selector*
  *to 2,000 kg. Set the TRIM TRANS AUTO      *
  *MASTER switch to "REARWARD". Check that - *
  *(a) tank 11 LH and RH inlet valves open,  *
  *(b) tank 9, LH and RH pumps start running *
  *    and                                   *
  *(c) tank 10 LOW PRESS captions are        *
  *    illuminated.                          *
  *Check by reference to FQIs that fuel is   *
  *transferring to tank 11. IF -             *
  *******************************************
              |    |
              |    |         ---------------------------------
              |    |        |1. Tank 11 inlet valve does not    |
              OK   NOT OK------|   open when auto master switch set|
              |             |   to REARWARD - Chart 113.        |
              |             |2. If both tank 9 pumps do not     |
              |             |   run - check associated wiring   |
              |             |   for continuity and renew        |
              |             |   Reaward Auto Trim Relay (115).  |
```

3. Tank 9 trim pump does not run when auto master switch set to REARWARD - Chart 114.
4. If a tank 10 pump runs when auto master switch set to REARWARD - renew Time Delay Unit (129) or (130). If fault not cleared, renew Pump Control Relay (127) or (128).
5. Tanks 9 and 10 LOW PRESS captions are not illuminated - check associated wiring for continuity and renew Rearward Auto Trim Slave Relay (116). If fault not cleared, renew LP Warning Inhibit Relay (117).

6. If any single tank 9 or 10 LOW PRESS caption does not illuminate, check associated wiring for continuity and renew LP Warning Inhibit Relay (117).

B. Set the FUEL FWD TRANS switch to "O/RIDE".
Check that -
(a) tank 11 LH and RH inlet valves close,
(b) tank 9 LH and RH inlet valves open,
(c) tank 9 LH and RH pumps are heard to stop running but LOW PRESS captions are not illuminated, and
(d) all four tank 11 pumps start running.
Check by reference to the FQIs that fuel is transferring to tank 9. IF -

OK

NOT OK

1. No effect on rearward fuel transfer when forward transfer switch set to O/RIDE - check for 28 V d.c. at panel 18-123, test module UT1854-5A and earth at test module UT1852-7B. If absent renew Fuel Forward Transfer O/ride Control Switch (108).
2. Tank 11 inlet valves close, tank 9 pumps stop running, but tank 11 pumps do not run and tank 9 inlet valves do not open - check associated wiring for continuity and renew Auto Transfer Override Relay (122).
3. If tank 11 pumps do not run - check associated wiring for continuity and renew Auto Transfer Override Relay (122).
4. If tank 9 LH or RH inlet valve does not open - check associated wiring for continuity and renew Auto Transfer Override Relay (122).

5. If fuel is seen to transfer but tank 11 LOW PRESS captions are not illuminated and then extinguished - check associated wiring for continuity and renew LP Warning Inhibit Relay (119).
6. Single tank 11 LOW PRESS caption is not illuminated and then extinguished when FUEL FWD TRANS switch set to O/RIDE - Chart 115

C. *CAUTION: IF TANK 11 INLET VALVES DO NOT CLOSE WITHIN THE TOLERANCE AS DETAILED, IMMEDIATELY SWITCH OFF TANK 9 TRIM PUMPS.*

Set FUEL FWD TRANS switch to 'locked' position. Ensure that -
(a) tank 11 LH and RH inlet valves open,
(b) tank 9 LH and RH inlet valves close,
(c) tank 11 pumps stop running but associated captions are not illuminated,
(d) tank 9 LH and RH pumps start running and
(e) tank 10 LOW PRESS captions are illuminated.

Ensure, by reference to the FQIs that fuel is transferring to tank 11. Allow transfer to continue until tank 11 FQI indicates 2,000(±230) kg. Check that within this tolerance -
(a) tank 11 inlet valves close,
(b) tanks 5 and 7 inlet valves open and
(c) LLC caption on FQI control panel (Ref. 28-44-00) is not illuminated.

Ensure by reference to the FQIs that fuel is transferring to tanks 5 and 7.

IF -

OK — NOT OK:

1. The LLC caption on the FQI control panel is illuminated, inlet valves close and pumps stop running, but not within tolerance specified - renew Load Limit Control Selector (111). If fault not cleared, renew Fuel Quantity Indicator (132). If fault not cleared, renew Standby 1 CG Pack (112) and/or Standby 2 CG Pack (113).
2. Tanks 5 and/or 7 inlet valves do not open after fuel transfer to tank 11 stops - Chart 116.

D. Allow transfer to continue until tank 9 FQI indicates 1,000(±460) kg. Check that within this tolerance -
(a) tank 5 and 7 inlet valves close,
(b) tank 9 pumps stop running, but associated captions are not illuminated,
(c) tank 10 LOW PRESS captions are extinguished, and
(d) LLC caption on FQI control panel is not illuminated. IF -

OK — NOT OK:

The LLC caption on the FQI control panel is illuminated, inlet valves close and pumps stop running, but not within tolerance specified - renew Load Limit Control Selector (110). If fault not cleared, renew Fuel Quantity Indicator (133). If fault not cleared, renew Standby 1 CG Pack (112) and/or Standby 2 CG Pack (113).

E. Set TRIM TRANS AUTO MASTER switch to "OFF"

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```
                |
                |
F.**********************************************
  *Set tanks 9 and 10 load limit selector to *
  *0 kg. Set TRIM TRANS AUTO MASTER switch   *
  *to "REARWARD".  Ensure that -             *
  *(a) tank 9 pumps run, 1                   *
  *(b) tank 10 pumps LOW PRESS captions are  *
  *    illuminated, and                      *
  *(c) tanks 5 and 7 inlet valves open.      *
  *Ensure, by reference to the FQIs that     *
  *fuel is transferring to tanks 5 and 7.    *
  *Trip tank 9 pumps control CBs (3) and (9).*
  *When the associated LOW PRESS captions are*
  *illuminated, check that, after a time     *
  *delay of 3.6 to 4.4 s, tank 10 pumps LOW  *
  *PRESS captions are extinguished.  IF -    *
  ********************************************
              |    |
              |    |            ----------------------------------
              |    |           |If time delay incorrect - check   |
             OK   NOT OK------|associated wiring for continuity  |
              |                |and renew Time Delay Unit (129) or|
              |                |(130). If fault not cleared, check|
              |                |associated wiring for continuity  |
              |                |and renew Pump Control Relay (127)|
              |                |or (128).                         |
              |                 ----------------------------------
              |
G.**********************************************
  *Reset tank 9 pump CBs (3) and (9).  Check *
  *that tank 9 pumps run and tank 10 pumps   *
  *continue to run. IF -                     *
  ********************************************
              |    |
              |    |            ----------------------------------
              |    |           |Tank 10 pump stops when CB reset -|
             OK   NOT OK------|check associated wiring for       |
              |                |continuity and renew Pump Control |
              |                |Relay (127) or (128).             |
              |                 ----------------------------------
```

```
                |
                |
H.*******************************************
  *Set TRIM TRANS AUTO MASTER switch to "OFF"*
  *for 10 s and then reset the switch to    *
  *"REARWARD". Check that tank 9 and 10 pumps*
  *stop running and when switch reset to    *
  *REARWARD only tank 9 pumps restart. IF -  *
  *******************************************
                |    |
                |    |                 -----------------------------------
                |    |                |Tank 10 pump restarts - renew Pump |
               OK   NOT OK------      |Control Relay (127) or (128).      |
                |                      -----------------------------------
                |
I.*******************************************
  *Check that fuel continues to transfer to  *
  *tanks 5 and 7.  When tank 9 is empty,     *
  *check that associated LOW PRESS captions  *
  *are illuminated. When tank captions are   *
  *illuminated, check that, after a time     *
  *delay of 3.6 to 4.4 s, tank 10 pumps start*
  *to run and continue to transfer fuel to   *
  *tanks 5 and 7.                            *
  *                                          *
  *NOTE:  The quantity of fuel being trans-  *
  *       ferred would cause tanks 5 and 7   *
  *       High Level Shut-off Sensors to     *
  *       close their inlet valves.          *
  *                                          *
  *Transfer 700 kg of fuel from tank 5 to    *
  *tank 2, and 600 kg from tank 7 to tank 3  *
  *(Ref. 28-00-00, Servicing).               *
  *Allow tank 10 to empty. Check that when   *
  *tank 10 FQI reaches 0(+460 -0) kg -       *
  *(a) tank 9 and 10 pumps stop running, but *
  *    captions are not illuminated,         *
  *(b) tanks 5 and 7 inlet valves close and  *
  *(c) the LLC caption is not illuminated.   *
  *IF -                                      *
  *******************************************
                |    |
```

```
                   |    |
                   |    |         ------------------------------------
                   |    |        |The LLC caption on the FQI control |
                   OK   NOT OK------|panel is illuminated, inlet valves |
                   |             |close and pumps stop running, but  |
                   |             |not within tolerance specified -   |
                   |             |renew Load Limit Control Selector  |
                   |             |(110). If fault not cleared, renew |
                   |             |Fuel Quantity Indicator (134). If  |
                   |             |fault not cleared, renew Standby   |
                   |             |1 CG Pack (112) and/or Standby     |
                   |             |2 CG Pack (113).                   |
                   |              ------------------------------------
                   |
J.*******************************************
  *Set TRIM TRANS AUTO MASTER switch to "OFF"*
  *******************************************
                   |
K.*******************************************
  *Set tank 9 and 10 load limit selector to  *
  *1,500 kg.  Set tank 11 load limit         *
  *selector to 0 kg.  Set TRIM TRANS AUTO    *
  *MASTER switch to "FORWARD".  Check that - *
  *(a) tank 11 pumps run, and                *
  *(b) tank 9 inlet valves open.             *
  *Ensure by reference to the FQIs that      *
  *fuel is transferring to tank 9. If -      *
  *******************************************
                   |    |
                   |    |         ------------------------------------
                   |    |        |1. Trim transfer auto master switch|
                   OK   NOT OK------|   at FORWARD with no effect on    |
                   |             |   transfer - Chart 117.           |
                   |             |2. Tank 11 pumps do not run when   |
                   |             |   trim transfer auto master switch|
                   |             |   set to FORWARD - Chart 118.     |
                   |             |3. Tank 9 inlet valve does not open|
                   |             |   when trim auto master switch set|
                   |             |   to FORWARD - Chart 119.         |
                   |              ------------------------------------
```

```
               |
L.*********************************************
  *When tank 9 FQI reads 1,500(+460 -0) kg,   *
  *check that -                               *
  *(a) LLC caption is not illuminated,        *
  *(b) tank 9 inlet valves close and          *
  *(c) tanks 5 and 7 inlet valves open.       *
  *IF -                                       *
  *********************************************
               |    |
               |    |                  -----------------------------------
               |    |                 |1. LLC caption is illuminated,     |
              OK   NOT OK------|   tank 9 inlet valves close,         |
               |                      |   tank 11 pumps stop running -       |
               |                      |   renew Load Limit Control           |
               |                      |   Selector (110).  If fault not      |
               |                      |   cleared, renew Standby CG Pack     |
               |                      |   (112) and/or (113).                |
               |                      |2. During normal forward fuel         |
               |                      |   transfer, tanks 5 and 7 inlet      |
               |                      |   valves do not open when tank 9     |
               |                      |   inlet valves close - Chart 120.    |
               |                       -----------------------------------
               |
M.*********************************************
  *Set FUEL FWD TRANS switch to "O/RIDE".     *
  *Ensure that -                              *
  *(a) tank 9 inlet valves open,              *
  *(b) tanks 5 and 7 inlet valves close and   *
  *(c) fuel transfers from tank 11 to tank 9.*
  *Allow tank 11 to empty. Ensure that -      *
  *(a) tank 11 LOW PRESS captions are illumi-*
  *    nated and remain illuminated, and      *
  *(b) tank 9 inlet valves remain open.       *
  *Set tank 11 LH and RH, GREEN and BLUE pump*
  *control switches to "OFF".                 *
  *Transfer fuel from tanks 5 and 7 into tank*
  *9 (Ref. 28-00-00, Servicing) to fill tank *
  *9.  When tank 9 inlet valves automatically*
  *close, check that tanks 5 and 7 inlet      *
  *valves open. IF -                          *
  *********************************************
               |    |
```

```
                |      |
                |      |             -----------------------------------
                |      |            |Tanks 5 and 7 inlet valves do not  |
               OK    NOT OK---------|open - check associated wiring for |
                |                   |continuity and renew Auto Transfer |
                |                   |Override Relay (122).              |
                |                    -----------------------------------
                |
N.**********************************************
  *Reset tank 11 pump switches to "OFF".       *
  *Reset FUEL FWD TRANS switch to 'locked'     *
  *position.  Ensure that tanks 5 and 7 inlet*
  *valves close. Reset TRIM TRANS AUTO MASTER*
  *switch to "OFF". Switch off the ground      *
  *pressurizing system (Ref. 29-23-00).        *
  *********************************************
```

6. Trouble Shooting - Load Limit Control, Zero Locking Inhibition

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).  *
  *With tank 9 full and tanks 10 and 11      *
  *empty, set tanks 9-10 load limit selector *
  *to 5,000 kg.  Set tank 11 load limit      *
  *selector to 50 kg.
  *Inhibit operation of tank 9 pumps by      *
  *tripping CBs (1) and (7).                 *
  *Set TRIM TRANS AUTO MASTER switch to      *
  *"REARWARDS".  Check that -                *
  *(a) tank 11 inlet valves remain closed,   *
  *(b) tanks 5 and 7 inlet valves open, and  *
  *(c) the LLC caption on the FQI control    *
  *    panel is not illuminated.             *
  *IF -                                      *
  *******************************************
              |    |
              |    |         -----------------------------------
              |    |        |Tank 11 inlet valves open when auto|
              OK   NOT OK------|master switch operated - check for |
              |             |earth at Standby 1 CG Pack (112)   |
              |             |connector P3, pin 24; if present,  |
              |             |check associated wiring. If there  |
              |             |is no earth, renew Load Limit Con- |
              |             |trol Selector (111). If fault not  |
              |             |cleared, renew Fuel Quantity       |
              |             |Indicator (132).                   |
              |              -----------------------------------
              |
B.*******************************************
  *Set tank 11 load limit selector to 250    *
  *kg.  Check that -                         *
  *(a) tank 11 inlet valves open,            *
  *(b) tanks 5 and 7 inlet valves close, and *
  *(c) the LLC caption is not illuminated.   *
  *IF -                                      *
  *******************************************
              |    |
```

```
                |       |
                |       |           ------------------------------------
                |       |          |Tank 11 inlet valves remain closed,|
                OK     NOT OK------|tanks 5 and 7 inlet valves remain  |
                |                  |open and LLC caption is illuminated|
                |                  | - renew Load Limit Control        |
                |                  |Selector (111). If fault not       |
                |                  |cleared, renew Standby CG Pack     |
                |                  |(112) and/or (113).                |
                |                   ------------------------------------
                |
C.*********************************************
  *Gradually decrease tank 11 load limit      *
  *selector setting until tank 11 inlet       *
  *valves close and tanks 5 and 7 inlet       *
  *valves open. Check that inlet valve        *
  *operations occur at a selector setting of *
  *between 180 and 0 kg.  IF -               *
  *********************************************
                |       |
                |       |           ------------------------------------
                |       |          |Inlet valve operations do not occur|
                OK     NOT OK------|at selector setting between 180 and|
                |                  |0 kg - renew Load Limit Control    |
                |                  |Selector (111). If fault not       |
                |                  |cleared, renew Standby CG Pack     |
                |                  |(112) and/or (113).                |
                |                   ------------------------------------
                |
  *********************************************
  *Set TRIM TRANS AUTO MASTER switch to "OFF"*
  *Ensure that tanks 5 and 7 inlet valves     *
  *close. Reset tank 9 pumps CBs (1) and (7).*
  *********************************************
```

```
*********************************      ------------------------------
*TRIM VALVE DOES NOT OPEN/CLOSE*      |GROUND EQUIPMENT REQUIRED     |
*WHEN O/RIDE CONTROL SWITCH    *      |------------------------------|
*OPERATED.                     *      |DESCRIPTION         PART NO.  |
*********************************      |------------------------------|
                                      |GROUND POWER SUPPLY  -        |
                                      |MULTIMETER           -        |
                                       ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------     -------------      ------------       -----------
|Repeat test|   |Disconnect   |    |With valve  |     |Renew Inlet|
|(Ref.para. |---|electrical   |-YES-|open, check |-NO-|Valve (102)|
|3.A.).Leave|   |connector B  |    |for continu-|     |(103),(106)|
|control    |   |from Valve   |    |ity between |     |(107),(104)|
|switch at  |   |(102),(103), |    |fixed conn- |     |or (105).  |
|OPEN.      |   |(106),(107), |    |ector B pins|      -----------
 -----------    |(104) or     |    |C-A. Check  |
                |(105). With  |    |for O/C be- |
                |control      |    |tween pins  |
                |switch at    |    |B-A. With   |
                |OPEN, check  |    |valve shut, |
                |free connect-|    |check for   |
                |or B for 28 V|    |continuity  |
                |d.c. at pin B|    |between     |       ----------
                |With control |    |fixed con-  |      |Check for |
                |switch at    |    |nector B,   |      |earth     |
                |SHUT, check  |    |pins B-A.   |-YES-|continuity|
                |free connec- |    |Check for   |      |at free   |
                |tor B for 28 |    |O/C between |      |connectors|
                |V d.c. at pin|    |pins C-A.   |      |A and B,  |
                |C.           |     ------------       |pins A.   |
                 -------------                          ----------
                       |
                       NO
                       |
                 -------------
                |*Renew Control|
                |Switch (76),  |
                |(77),(80),    |
                |(81),(78) or  |
                |(79).         |
                 -------------
```

Chart 101

```
********************************
*TRIM VALVE MAGNETIC INDICATOR*
*FAULTY WITH CORRECT VALVE    *
*OPERATION.                   *
********************************
```

GROUND EQUIPMENT REQUIRED

DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------       ---------------------          ---------------
|Disconnect |     |With electrical power |       |*Renew Indicator |
|electrical |----|on, check for 28 V d.c. |-NO-|(88),(89),(92),  |
|connectors |     |supply at free connector|      |(93),(90) or (91).|
|A, B and C |     |C, pin C.              |        ---------------
|at Valve   |      ---------------------
|(102),(103)|               |
|(106),(107)|              YES
|(104) or   |               |
|(105).     |      ---------------------
 -----------      |Earth free connector pin|
 -----------      |C, then pin B. Check   |
|Renew      |-NO-|indicator displays     |
|Indicator  |     |bar-across-line, then  |
|(88),(89), |     |bar-in-line.           |
|(92),(93)  |      ---------------------
|(90) or    |               |
|(91).      |              YES
 -----------                |
             ------------------------------          ------------
            |With valve shut, check for con-  |      |Renew Inlet  |
            |tinuity through valve fixed con- |-NO-|Valve (102), |
            |nector C, pin C, and either pin A|     |(103),(106), |
            |at fixed connectors A and B.     |     |(107),(104)  |
             ------------------------------         |or (105).    |
                            |                        ------------
                           YES
                            |                        ------------
             ------------------------------         |Renew Inlet  |
            |Reconnect electrical connector B |     |Valve (102), |
            |and open valve. Disconnect elec- |-NO-|(103),(106), |
            |trical connector B. Check for    |     |(107), (104) |
            |continuity through fixed connec- |     |or (105).    |
            |tor C, pin B, and either pin A at|      ------------
            |fixed connectors A and B.        |
             ------------------------------
```

Chart 102

TRIM VALVE DOES NOT OPEN/CLOSE WHEN MAIN CONTROL SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Leave electrical power on and set MAIN control switch to "OPEN".

→ Disconnect electrical connector A from Valve (102),(103) (106),(107) (104) or (105). Check free connector A for 28 V d.c. at pin B. With control switch at SHUT, check free connector A for 28 V d.c. at pin C.

-YES- → With valve open, check for continuity between fixed connector A, pins C-A. Check for O/C between pins B-A. With valve shut, check for continuity between fixed connector A, pins B-A. Check for O/C between pins C-A.

-NO- → Renew Inlet Valve (102) (103),(106) (107),(104) or (105).

-YES- → Check for earth continuity at free connector A, pin A.

NO

Continued on Sheet 2

Chart 103 (Sheet 1 of 2)

Continued from Sheet 1

Check CB (25),(23), (28),(27), (32) or (31) for 28 V d.c. output.

-NO- Renew CB (25),(23), (28),(27), (32) or (31).

-YES- Reset control switch open. At Control Relay (94),(95),(98), (99),(96) or (97); check for 28 V d.c. supply at test module terminal:-

Tank		Panel
9 LH	-	15-123, UT1851-5A,
9 RH	-	18-123, UT1852-5A,
5	-	15-123, UT1851-6A,
7	-	18-123, UT1852-6A
11 LH	-	15-123, UT1851-5C,
11 RH	-	18-123, UT1852-5C,

--NO- *Renew Main Control Switch (82),(83),(86),(87),(84), or (85). Is fault cleared?

-NO- *Renew O/ride Control Switch (76),(77),(80),(81),(78) or (79). Is fault cleared for tank 11 LH?

NO

*Renew C/O Relay (131)

YES

Remove Control Relay (94) (95),(98),(99),(96) or (97). Check for continuity through relay pins X1-X2, A2-A3 and O/C through pins A2-A1.

NO

*Renew Control Relay (94),(95), (98),(99),(96) or (97).

YES

Trouble shoot earth return circuit for High Level Switching in LH Level Switch Pack (100) or RH Level Switching Pack (101) (Ref. 28-42-00, TRouble Shooting).

Chart 103 (Sheet 2 of 2)

TRIM PUMP 'LOW PRESS' CAPTIONS ARE ILLUMINATED WHEN CONTROL SWITCHES ARE AT 'AUTO' AND 'AUTO MASTER' SWITCH IS AT 'OFF'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------     ---------------
|Are all    |-YES-|*Renew CB (16). |
|captions   |      ---------------
|illumi-    |
|nated?     |
 -----------      ---------------
     |           |Are tank 11 LP |
     NO          |captions       |
     |        |--|illuminated?   |
 ------------ |   ---------------
|Are tank 9  |-NO-        |
|and 10 LP   |           YES
|captions    |            |
|illuminated?|     ---------------      ----------------
 ------------     |*Renew Forward |    |*Renew LP        |
     |            |Auto Trim Slave|-NO-|Warning Inhibit  |
    YES           |Relay (118). Is|    |Relay (119).     |
     |            |fault cleared? |     ----------------
 --------------    ---------------
|*Renew        |
|Rearward Auto |
|Trim Slave    |    ----------------
|Relay (116).  |-NO-|*Renew LP Warning|
|Is fault      |    |Inhibit Relay    |
|cleared?      |    |(117).           |
 --------------      ----------------
```

Chart 104

Printed in England

```
***********************************
*TRIM PUMP RUNS BUT 'LOW PRESS'*
*CAPTION IS NOT ILLUMINATED    *
*WHEN PUMP SWITCHED 'ON'.      *
***********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

<u>NOTE</u>: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------      -------------       ------------
|Set pump   |    |Disconnect   |     |*Renew      |
|control    |---|electrical   |-YES-|Pressure    |
|switch to  |    |connector at |     |Switch (52),|
|"ON".      |    |Pressure     |     |(53),(54),  |
 -----------     |Switch (52), |     |(55),(72) or|
                 |(53),(54),   |     |(73).       |
                 |(55),(72) or |      ------------
                 |(73). Check  |
                 |free connec- |      -------------
                 |tor for 28 V |     |Remove filler|
                 |d.c. at pin A|     |plug from    |
                  -------------      |terminal 3 of|
                        |            |Caption Light|      ----------
                        NO           |Module (40), |     |Renew Low |
                        |            |(41),(42),   |     |Pressure  |
 -----------      -------------      |(43),(60) or |-NO-|Caption   |
|Renew CB   |    |Check for 28|     |(61). Apply  |     |Light     |
|(4),(6),   |-NO-|V d.c.      |-YES-|local earth  |     |Module    |
|(13) or    |    |output at   |     |to terminal  |     |(40),(41),|
|(19).      |    |CB (4),(6), |     |3. Is caption|     |(42),(43),|
 -----------     |(13) or (19)|     |illuminated? |     |(60) or   |
                  ------------        -------------      |(61).     |
                                            |             ----------
                                           YES
                                            |
                                      -------------------
                                     |*Renew Pump Control|
                                     |Switch (36),(37),  |
                                     |(38),(39),(56) or  |
                                     |(57).              |
                                      -------------------
```

Chart 105

Printed in England

R **ON A/C 001-005,

```
*********************************
*TRIM PUMP DOES NOT RUN AND     *
*'LOW PRESS' CAPTION REMAINS    *
*ILLUMINATED WHEN PUMP          *
*SWITCHED ON.                   *
*********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------      --------------------         --------------------
|Set pump|    |Disconnect electrical|       |Renew Fuel Pump (48),|
|control |----|connector at Fuel     |-YES-|(49),(50),51),(68) or|
|switch  |    |Pump (48),(49),(50),   |     |(69).                |
|to "ON".|    |(51),(68) or (69).     |      --------------------
 --------     |Check free connector   |
              |for 200/115 V a.c.     |     -------------         -------
              |3-ph supply.           |    |At Contactor |       |*Renew |
               --------------------        |(44),(45),   |-YES-|Pump   |
                        |                  |(46) or (47),|      |Control|
                        NO                 |check for 115|      |Contac-|
                        |                  |V a.c. across|      |tor    |
 ---------      ---------------            |terminals    |      |(44),  |
|Check CB |    |Remove terminal|           |X1-X2. At    |      |(45),  |
|(1),(2), |-NO-|block cover    |           |Relay (64) or|      |(46) or|
|(7),(8)  |    |from pump Con- |--YES-     |(65), check  |      |(47) or|
|(11) or  |    |trol Contactor |           |for 28 V d.c.|      |Pump   |
|(17) for |    |(44),(45),(46) |           |across socket|      |Control|
|200/115 V|    |or (47), or re-|           |pins X1-X2.  |      |Relay  |
|a.c. 3-ph|    |move Pump Con- |            -------------       |(64) or|
|output.  |    |trol Relay (64)|                  |             |(65).  |
 ---------     |or (65). Check |                  NO             -------
     |         |for 200/115 V  |                  |
     NO        |a.c. at Contac-|      ----------------------------------
     |         |tor (44) to    |     |Check CB (3),(9),(5) or (10) for|
 ------------  |(47) terminals |     |115 V a.c. output. Check CB (12)|
|Renew CB (1)| |A,B, and C, or |     |or (18) for 28 V d.c. output.   |
|(2),(7),    | |Relay (64) or  |      ----------------------------------
|(8),(11) or | |(65) socket    |      |                    |
|(17).       | |pins A2,B2 and |      NO                   YES
 ------------  |C2.            |      |                    |
                ---------------       |      ----------------------------
  -----------------------------------       |*Renew Pump Control         |
 |Renew CB (3),(9),(5),(10),(12) or |       |Switch (36),(37),(38),      |
 |(18).                             |       |(39),(56) or (57).          |
  -----------------------------------        ----------------------------
```

Chart 106

```
********************************       ------------------------------
*After SB 28-048: TRIM PUMP    *      |GROUND EQUIPMENT REQUIRED     |
*DOES NOT RUN AND 'LOW PRESS' *       |------------------------------|
*CAPTION REMAINS ILLUMINATED   *      |DESCRIPTION          PART NO. |
*WHEN PUMP SWITCHED ON.        *      |------------------------------|
********************************      |GROUND POWER SUPPLY    -      |
                                      |MULTIMETER             -      |
                                      |INSULATED LINK         -      |
                                       ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ---------       ---------------------        ---------------------
|Set pump |----|Disconnect electrical |-YES-|Renew Fuel Pump (48),|
|control  |    |connector at Fuel Pump|     |(49),(50),(51),(68)  |
|switch   |    |(48),(49),(50),(51),  |     |or (69).             |
|to "ON". |    |(68) or (69). Check   |      ---------------------
 ---------     |free connector for    |
               |200/115 V a.c. 3-ph   |
               |supply.               |
                ----------------------
                          |
                          NO
                          |
             -----------------------         --------------------
    --YES-|Check CB (1),(2),(7),(8), |-NO-|Renew CB (1),(2),(7),|
    |     |(11) or (17) for 200/115 V|    |(8),(11) or (17).    |
    |     |a.c. 3-ph output.         |     --------------------
    |      -------------------------
    |
    |----- -------------------------         ------------------
    |     |Remove Pump Control Relay |-YES-|*Renew Pump Control|
    |     |(64) or (65); check for 28|     |Relay (64) or (65) |
 FOR TANKS|V d.c. across socket pins |      ------------------
 9 AND 10 |X1-X2.                    |
 PUMPS ONLY -------------------------
    |                     |
    |                     NO
    |                     |
    |      -------------------------         ------------------
    |     |Check CB (12) or (18) for |-YES-|*Renew Pump Control |
    |     |28 V d.c. output.         |     |Switch (56) or (57).|
    |      -------------------------         ------------------
    |                     |
    |                     |    ----------------------
    |                     NO-|Renew CB (12) or (18).|
    |                          ----------------------
```

Continued on Sheet 2.

Chart 106A (Sheet 1 of 2)

Continued from Sheet 1

```
       |
 ----------------------           ---------------------
|Check CB (3),(9),(5)|-NO--|Renew CB (3),(9),(5)|
|or (10) for 115 V   |     |or (10).            |
|a.c. output.        |      ---------------------
 ----------------------
       |
      YES
       |
 ----------------------------------    -------------------
|Remove connector from Pump Start|-NO-|*Renew Pump Control|
|Control Unit (135),(136),(137)  |    |Switch (36),(37),   |
|or (138). Check free connector  |    |(38) or (39).       |
|pin 1 for 115 V a.c. supply.    |     -------------------
 ----------------------------------
       |
      YES
       |
 ------------------------------        -------------------------------
|Trip CB (3),(9),(5) or (10).|--NO-|*Renew Pump Control Contactor|
|Link free connector pins 2  |     |(44),(45),(46) or (47).      |
|and 4. Reset CB (3),(9),(5) |      -------------------------------
|or (10). Does pump start?   |
 ------------------------------
       |
      YES
       |
 ---------------------------
|*Renew Pump Start Control |
|Unit (135),(136),(137) or |
|(138).                    |
 ---------------------------
```

Chart 106A (Sheet 2 of 2)

R **ON A/C 006-007,

****
*TRIM PUMP DOES NOT RUN AND *
*'LOW PRESS' CAPTION REMAINS *
*ILLUMIMATED WHEN PUMP *
*SWITCHED ON. *
****

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
INSULATED LINK	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Set pump control switch to "ON". → Disconnect electrical connector at Fuel Pump (48),(49),(50),(51), (68) or (69). Check free connector for 200/115 V a.c. 3-ph supply.

- YES → Renew Fuel Pump (48),(49),(50),(51),(68) or (69).
- NO ↓

Check CB (1),(2),(7),(8), (11) or (17) for 200/115 V a.c. 3-ph output.

- NO → Renew CB (1),(2),(7),(8),(11) or (17).
- YES ↓

FOR TANKS 9 AND 10 PUMPS ONLY:

Remove Pump Control Relay (64) or (65); check for 28 V d.c. across socket pins X1-X2.

- YES → *Renew Pump Control Relay (64) or (65)
- NO ↓

Check CB (12) or (18) for 28 V d.c. output.

- YES → *Renew Pump Control Switch (56) or (57).
- NO → Renew CB (12) or (18).

Continued on Sheet 2.

Chart 106 (Sheet 1 of 2)

```
Continued from Sheet 1
      |
      |
 --------------------              -------------------
|Check CB (3),(9),(5)|-NO--|Renew CB (3),(9),(5)|
|or (10) for 115 V   |     |or (10).            |
|a.c. output.        |      -------------------
 --------------------
      |
     YES
      |
 ---------------------------------          ------------------
|Remove connector from Pump Start|-NO-|*Renew Pump Control|
|Control Unit (135),(136),(137)  |    |Switch (36),(37),   |
|or (138). Check free connector  |    |(38) or (39).       |
|pin 1 for 115 V a.c. supply.    |     ------------------
 ---------------------------------
      |
     YES
      |
 ----------------------------      ----------------------------
|Trip CB (3),(9),(5) or (10).|--NO-|*Renew Pump Control Contactor|
|Link free connector pins 2  |     |(44),(45),(46) or (47).      |
|and 4. Reset CB (3),(9),(5) |      ----------------------------
|or (10). Does pump start?   |
 ----------------------------
      |
     YES
      |
 --------------------------
|*Renew Pump Start Control |
|Unit (135),(136),(137) or |
|(138).                    |
 --------------------------
```

Chart 106 (Sheet 2 of 2)

```
*******************************
*TRIM PUMP RUNS BUT 'LOW      *
*PRESS' CAPTION IS NOT        *
*ILLUMINATED WHEN PUMP        *
*SWITCHED ON.                 *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------    ------------    -----------
|Set pump   |  |Disconnect  |  |*Renew     |
|control    |--|electrical  |-YES-|Pressure|
|switch to  |  |connector   |  |Switch (74)|
|"ON".      |  |at Pressure |  |or (75).   |
 -----------   |Switch (74) |   -----------
               |or (75).    |
               |Check for 28|
               |V d.c. at   |
               |free connec-|
               |tor pin A.  |
                ------------
                     |
                     NO
                     |
 -----------    ------------       ------------        -----------
|Renew CB   |  |Check for 28|     |Remove      |      |Renew Low  |
|(15) or    |-NO-|V d.c. out-|-YES-|filler plug |-NO-|Pressure   |
|(21).      |  |put at CB   |     |from termi- |      |Caption    |
 -----------   |(15) or (21)|     |nal 3 of    |      |Light      |
                ------------      |Caption     |      |Module (62)|
                                  |Light Module|      |or (63).   |
                                  |(62) or (63)|       -----------
                                  |Apply local |
                                  |earth to    |
                                  |terminal 3. |
                                  |Is caption  |
                                  |illuminated?|
                                   ------------
                                        |
                                       YES
                                        |
                               -------------------
                              |*Renew Pump Control|
                              |Switch (58) or (59).|
                               -------------------
```

Chart 107

```
********************************
*TRIM PUMP DOES NOT RUN AND    *
*'LOW PRESS' CAPTION REMAINS   *
*ILLUMINATED WHEN PUMP         *
*SWITCHED ON.                  *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------       -----------        ------------        -----------
|Set pump   |     |Disconnect |      |Check fixed |      |Renew Fuel |
|control    |-----|electrical |-YES-|connector   |-YES-|Pump       |
|switch to  |     |connector  |      |for conti-  |      |Hydraulic  |
|"ON".      |     |at Hydrau- |      |nuity betwe-|      |Motor (70) |
 -----------      |lic Selec- |      |en pins A-C.|      |or (71). Is|
                  |tor Valve  |       ------------       |fault      |
                  |(66) or    |            |             |cleared?   |
                  |(67). Check|            NO             -----------
                  |free con-  |            |                  |
                  |nector for |       ------------            NO
                  |28 V d.c.  |      |Renew Selec-|           |
                  |at pin A.  |      |tor Valve   |       -----------
                   -----------       |(66) or     |      |Trouble    |
                        |            |(67).       |      |shoot      |
                        NO            ------------       |hydraulic  |
                        |                                |power      |
 -----------       -----------        ------------       |supplies   |
|Renew CB   |     |Check CB   |      |*Renew Pump |      |(Ref.      |
|(14) or    |-NO-|(14) or    |-YES-|Control     |      |Chap.      |
|(20).      |     |(20) for   |      |Switch (58) |      |29).       |
 -----------      |28 V d.c.  |      |or (59).    |       -----------
                  |output.    |       ------------
                   -----------
```

Chart 108

```
*********************************
*TANK 11 LH PUMP DOES NOT RUN *
*AND 'LOW PRESS' CAPTION IS    *
*ILLUMINATED WHEN 'DE-AIR'     *
*SWITCH SET TO 'ON'.           *
*********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------     ------------     -----------      -----------
|Set DE-AIR |   |Remove Relay|   |Check for  |    |Remove     |
|switch to  |---|(115). Check|-YES-|continuity |-YES-|Relay (121)|
|"ON".      |   |for 28 V    |   |through    |    |Check for  |
 -----------    |d.c. at     |   |relay pins |    |continuity |
                |relay socket|   |C2-C3      |    |through    |
                |pin C2.     |    -----------     |relay pins |
                 ------------          |          |A2-A3.     |
                       |               NO          -----------
                       NO              |                |
                       |          -----------           NO
                 ------------    |*Renew     |          |
                |*Renew      |   |Relay (115)|     -----------
                |Control     |    -----------     |*Renew     |
                |Switch (120)|                    |Relay (121)|
                 ------------                      -----------
```

Chart 109

```
********************************
*TANK 11 PUMP (DE-AIR) DOES    *
*NOT STOP RUNNING WHEN 'TRIM   *
*TRANS AUTO MASTER' SWITCH     *
*SET TO 'REARWARD'.            *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
BREAKOUT BOARD	-

NOTE: Before renewal of components (*), check the associated run of wiring for continuity.

```
 -----------     -------------      -----------       -----------
|Set tanks 9|   |Check for    |    |Check for  |     |*Renew Fuel|
|and 10 LH  |---|earth at     |-NO-|earth at   |-NO- |Forward    |
|and RH PUMP|   |panel 18-123 |    |Trim Trans-|     |Transfer   |
|control    |   |test module  |    |fer Auto   |     |O/ride Con-|
|switches to|   |terminal     |    |Master Con-|     |trol Switch|
|"OFF". Set |   |UT1852-6D.   |    |trol Switch|     |(108).     |
|trim trans.|    -------------     |(109) termi-|     -----------
|auto master|          |           |nal 5.     |
|switch to  |         YES           -----------
|"REARWARD".|          |                 |
 -----------           |                YES
                       |                 |
                       |            -----------
 -----------           |           |*Renew Trim|
|*Renew     |          |           |Transfer   |
|Rearward   |          |           |Auto Master|
|Auto Trim  |          |           |Control    |
|Relay (115)|          |           |Switch (109)|
 -----------       -----------      -----------
      |           |Check for 28|
      NO          |V d.c. at   |
      |           |panel 18-123|
 ----------       |test module |
|Check for-|-YES- |terminal    |
|28 V d.c. |      |UT1852-5C.  |
|at panel  |       -----------
|18-123,   |            |
|test      |            NO
|module    |            |
|terminal  |            |
|UT1854-1C.|            |
 ----------             |
      |                 |
```

Continued on Sheet 2

Chart 110 (Sheet 1 of 3)

Continued from Sheet 1

```
      |                    |
     YES                  NO
      |                    |
 -----------     ---------------     ------------     -----------
|*Renew Trim|   |Check for 28 V |   |Check for 28|   |Renew CB   |
|/De-air    |   |d.c. supply to |-NO-|V d.c. out- |-NO-|(34).      |
|Interlock  |   |Trim Transfer  |   |put at CB   |    -----------
|Relay (121)|   |Auto Master    |   |(34).       |
 -----------    |Control Switch |    ------------
                |(109), to      |         |
                |terminal 2.    |        YES
                 ---------------          |
                        |            ------------------
                       YES          |*Renew Fuel Forward|
                        |           |Transfer O/ride    |
               -----------------    |Control Switch     |
              |Check for 28 V   |   |(108).             |
              |d.c. at Trim     |    ------------------
              |Transfer Auto    |    ------------------
              |Master Control   |   |Renew Trim Transfer|
              |Switch (109),    |-NO-|Auto Master Control|
              |terminal 3.      |   |Switch (109).      |
               -----------------     ------------------
                        |
                       YES
                        |
 -----------------     ---------------     ------------
|Check for 115 V  |   |Check for 115 V|   |Check for 115|
|a.c. at Standby 1|-NO-|a.c. at Trim   |-NO-|V a.c. output|
|CG Pack (112),   |   |Transfer Auto  |   |from CB (35).|
|connector P3, pin|   |Master Control |   |If absent re-|
|61.              |   |Switch (109),  |   |new CB (35), |
 -----------------    |terminal 9.    |   |If present,  |
        |              ---------------    |renew Trim   |
       YES                   |            |Transfer Auto|
        |                   YES           |Master Con-  |
        |                    |            |trol Switch  |
        |             ---------------     |(109).       |
        |            |*Renew Forward |     ------------
        |            |Auto Trim Relay|
        |            |(114).         |
        |             ---------------
        |
```

Continued on Sheet 3

Chart 110 (Sheet 2 of 3)

```
                Continued from Sheet 2
                |
 -----------------          --------------
|Check for 28 V   |-NO-|Renew Standby  |
|d.c. at Standby 1 |    |1 CG Pack      |
|CG Pack (112) con-|    |(112). Is fault|
|nector P3, pin 13.|    |cleared?       |
 -----------------          --------------
         |                        |
        YES                       NO
         |                        |
 -----------------          --------------          ------------
|Renew Standby 2 CG|-NO-|*Renew Load    |-NO-|*Renew       |
|Pack (113). Is    |    |Limit Control  |    |associated  |
|fault cleared?    |    |Selector (110).|    |Tank 9 and/or|
 -----------------      |Is fault       |    |10 Fuel     |
                        |cleared?       |    |Quantity    |
                         --------------      |Indicator   |
                                             |(133) or    |
                                             |(134).      |
                                              ------------
```

Chart 110 (Sheet 3 of 3)

```
*******************************
*'T/O CG' SWITCH RESETS TO    *
*'NORM' WHEN A SINGLE TANK 9  *
*OR 10 PUMP SWITCHED ON.      *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------         -----------------
|Does fault occur|       |*Renew Pump      |
|when tank 9 LH, |-YES-  |Control Contactor|
|then tank 10 LH,|       |(45) or (47).    |
|switch is set to|        -----------------
|ON?             |
 ----------------
        |
        NO
        |
 -----------------        -----------------
|Fault occurs when|      |*Renew Pump      |
|tank 9 RH then   |----  |Control Contactor|
|tank 10 RH switch|      |(44) or (46).    |
|at ON.           |       -----------------
 -----------------
```

Chart 111

```
**********************************
*'TO CG' SWITCH DOES NOT         *
*RESET TO 'NORM' WHEN TANK 9     *
*LH AND RH PUMPS SWITCHED 'ON'*
**********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 ----------------           ----------------
|With pumps       |        |Renew Pump       |
|switches still at|-NO-|Control Contactor|
|ON, remove termi-|        |(44).            |
|nal cover from   |         ----------------
|Pump Control     |
|Contactor        |
|(47). Check for  |
|28 V d.c. at     |
|contactor termi- |
|nal 3.           |
 ----------------
         |
        YES
         |
 ----------------
|Renew Pump       |
|Control Contactor|
|(45).            |
 ----------------
```

Chart 112

TANK 11 INLET VALVE DOES NOT OPEN WHEN 'AUTO MASTER' SWITCH SET TO 'REARWARD'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
BREAK-OUT BOARD	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check for 28 V d.c. at tank 11 LH Main Inlet Valve Control Switch (84), terminal 6 or:- Tank 11 RH Main Inlet Valve Control Switch (85), terminal 1.
- NO → Renew Main Inlet Valve Control Switch (84) or (85).
- YES ↓

Check for 28 V d.c. at Stand-by 1 CG Pack (112), connector 3, pin 22 (LH), or pin 23 (RH).
- NO → *Renew Standby 1 CG Pack (112). Is fault cleared? — NO → Renew Load Limit Control Selector (111). Is fault cleared? — NO → *Renew Fuel Quantity Indicator (132).
- YES ↓

Check for 28 V d.c. at Standby 2 CG Pack (113) connector 3, pin 22 (LH), or pin 23 (RH).
- NO → *Renew Standby 2 CG Pack (113). Is fault cleared? — NO → *Renew Load Limit Control Selector (111). Is fault cleared? — NO → *Renew Fuel Quantity Indicator (132).

Chart 113

TANK 9 TRIM PUMP DOES NOT RUN WHEN 'AUTO MASTER' SWITCH SET TO 'REARWARD'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

<u>NOTE</u>: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------       ----------------       ----------------
|Remove Pump     |     |Check for 28 V  |     |*Renew Rearward |
|Control Relay   |-----|d.c. at relay   |-NO-|Auto Trim Relay |
|(125) or (126). |     |socket, pin X1. |     |(115).          |
 ----------------       ----------------       ----------------
                               |
                              YES
                               |
                        ----------------       ----------------
                       |Check for 115 V |     |*Renew Pump     |
                       |a.c. at relay   |-NO-|Control Switch  |
                       |socket pin A2.  |     |(36) or (37).   |
                        ----------------       ----------------
                               |
                              YES
                               |
                        ----------------
                       |Renew Pump Control|
                       |Relay (125) or    |
                       |(126).            |
                        ----------------
```

Chart 114

```
*******************************
*SINGLE TANK 11 'LOW PRESS'   *
*CAPTION IS NOT ILLUMINATED   *
*AND THEN EXTINGUISHED WHEN   *
*'FUEL FWD TRANS' SWITCH SET  *
*TO 'O/RIDE'                  *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -------------           -------------------          ----------------
|Is fault in  |         |Is pump heard to   |        |*Renew LP Warning|
|GREEN or BLUE|-YES-    |run?               |-YES-   |Inhibit Relay    |
|pumps system?|         |                   |        |(119).           |
 -------------           -------------------          ----------------
      |                           |
      NO                          NO
      |                           |
      |                  -------------------          ----------------
      |                 |Remove Pump Control|        |*Renew Pump      |
      |                 |Relay (123) or (124)|-YES-  |Control Relay    |
      |                 |Check for 28 V d.c.|        |(123) or (124).  |
      |                 |supply at relay    |         ----------------
      |                 |socket pin A2.     |
      |                  -------------------
      |                           |
      |                           NO
      |                           |
      |                  --------------------
      |                 |*Renew Pump Control |
      |                 |Switch (58) or (59).|
      |                  --------------------
      |
 --------------            --------------------
|Is pump heard |          |*Renew LP Warning   |
|to run?       |-YES-     |Inhibit Relay (119).|
 --------------            --------------------
      |
      NO
      |
 --------------------
|*Renew Pump Control |
|Switch (56) or (57).|
 --------------------
```

Chart 115

```
*******************************
*TANK 5 AND/OR 7 INLET VALVES *
*DO NOT OPEN AFTER FUEL       *
*TRANSFER TO TANK 11 STOPS.   *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------        -----------        -----------         -----------
|Remove In- |      |Check Relay|      |Refit Relay|       |Renew Inlet|
|let Valve  |-YES-|(96) for    |-YES-|(96).Remove|--NO-|Valve Con- |
|Control    |      |continuity |      |Inlet Valve|       |trol Relay |
|Relay (96).|      |through    |      |Control    |       |(97).      |
|Check for  |      |pins B2-B3.|      |Relay (97).|        -----------
|28 V d.c.  |       -----------       |Check for  |
|at relay   |            |            |continuity |
|socket pin |            NO           |through    |
|B2.        |            |            |relay pins |
 -----------        -----------       |B2-B3.     |
      |            |Renew Inlet|       -----------
      NO           |Valve Con- |            |
      |            |trol Relay |            YES
 -----------       |(96).      |            |
|*Renew     |       -----------        -----------
|Rearward   |                         |*Renew Main|
|Auto Trim  |                         |Inlet Valve|
|Relay (115)|                         |Control    |
 -----------                          |Switch (86)|
                                      |or (87).   |
                                       -----------
```

Chart 116

```
********************************
*'TRIM TRANS AUTO MASTER'      *
*SWITCH AT 'FORWARD', WITH NO  *
*EFFECT ON TRANSFER.           *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
BREAK-OUT BOARD	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------         -----------         -----------         -----------
|Remove     |       |Check for  |       |Check for  |       |*Renew Fwd.|
|Forward    |-YES-  |28 V d.c.  |-YES-  |earth at   |-YES-  |Auto Trim  |
|Auto Trim  |       |supply at  |       |panel      |       |Relay (114)|
|Relay (114)|       |panel      |       |18-123,test|        -----------
|Check for  |       |18-123,test|       |module     |
|28 V d.c.  |       |module     |       |UT1852-7B. |
|supply at  |       |UT1852-7A. |        -----------
|relay      |        -----------              |
|socket pins|             |                   NO
|B1 and D2. |             NO                  |
 -----------              |              ------------
      |                   |             |*Renew Trim |
      NO                  |             |Trans Auto  |
      |                   |             |Master Switch|
 -----------              |             |(109).      |
|*Renew Trim|             |              ------------
|Transfer   |        ------------
|Auto Master|       |Check for 28|         ------------
|Control    |       |V d.c. at   |        |*Renew Standby|
|Switch     |       |Standby 1 CG|        |2 CG Pack     |
|(109).     |       |Pack (112), |-YES-   |(113).        |
 -----------        |connector   |         ------------
                    |P3, pin 21. |
                     ------------
                          |
                          NO
                          |
                   --------------
                  |Renew Standby |
                  |1 CG Pack (112)|
                   --------------
```

Chart 117

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```
*******************************
*TANK 11 PUMPS DO NOT RUN WHEN*
*'TRIM TRANS AUTO MASTER'     *
*SWITCH SET TO 'FORWARD'.     *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------          -----------------          -----------------
|Check for 28 V  |        |*Renew Auto      |        |*Renew Forward   |
|d.c. supply at  |-NO-|Transfer Override |-NO-|Auto Trim Relay  |
|panel 18-123,   |        |Relay (122). Is  |        |(114).           |
|test module     |        |fault cleared?   |         -----------------
|UT1852-4A.      |         -----------------
 ----------------
```

Chart 118

TANK 9 INLET VALVE DOES NOT OPEN WHEN 'TRIM TRANS AUTO MASTER' SWITCH SET TO 'FORWARD'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-
BREAK-OUT BOARD	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check for 28 V d.c. supply at Tank 9 LH Main Inlet Valve Control Switch (82), terminal 6 or:- Tank 9 RH Main Inlet Valve Control Switch (83), terminal 6.

-NO- → Renew Main Inlet Valve Control Switch (82) or (83).

YES ↓

Check for 28 V d.c. supply at Standby 2 CG Pack (113) connector P3 pin 14 (LH), pin 15 (RH).

-NO- → Check for 28 V d.c. supply at Standby 1 CG Pack (112), connector P3, pin 14 (LH), pin 15 (RH).

-NO- → *Renew Standby 1 CG Pack (112).

YES ↓ → *Renew Standby 2 CG Pack (113).

YES ↓ (from Standby 2 CG Pack check) → *Renew Auto Transfer Override Relay (122)

Chart 119

DURING NORMAL FORWARD FUEL TRANSFER, TANKS 5 AND 7 INLET VALVES DO NOT OPEN WHEN TANK 9 INLET VALVES CLOSE.

GROUND EQUIPMENT REQUIRED

DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Remove Valve Control Relay (94) Check for 28 V d.c. supply at relay socket pin B2.

- YES → *Renew Valve Control Relay (94). Is fault cleared?
  - NO → *Renew Valve Control Relay (95).
- NO → *Renew Forward Auto Trim Relay (114).

Chart 120

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1) Circuit breaker 200/115 V	-	14-215	1Q189	Map ref.C17	24-50-00 R/I	28-23-01
(2) Circuit breaker 200/115V	-	14-216	1Q190	Map ref.B1	24-50-00 R/I	28-23-01
(3) Circuit breaker 115 V	-	14-215	1Q181	Map ref.D15	24-50-00 R/I	28-23-01
(4) Circuit breaker 28 V	-	15-215	Q182	Map ref.D21	24-50-00 R/I	28-23-01
(5) Circuit breaker 115 V	-	14-216	1Q184	Map ref.C3	24-50-00 R/I	28-23-01
(6) Circuit breaker 28 V	-	15-216	Q183	Map ref.D1	24-50-00 R/I	28-23-01
(7) Circuit breaker 200/115 V	-	13-216	2Q189	Map ref.B1	24-50-00 R/I	28-23-03
(8) Circuit breaker 200/115V	-	13-215	2Q190	Map ref.C19	24-50-00 R/I	28-23-03
(9) Circuit breaker 115 V	-	13-216	2Q181	Map ref.E3	24-50-00 R/I	28-23-03
(10) Circuit breaker 115 V	-	13-215	2Q184	Map ref.B16	24-50-00 R/I	28-23-03
(11) Circuit breaker 200/115 V	-	13-216	Q1375	Map ref.F4	24-50-00 R/I	28-23-02
(12) Circuit breaker 28 V	-	15-216	Q187	Map ref.D3	24-50-00 R/I	28-23-02
(13) Circuit breaker 28 V	-	15-215	Q1388	Map ref.E21	24-50-00 R/I	28-23-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(14) Circuit breaker 28 V	-	1-213	1Q185	Map ref.J18	24-50-00 R/I	28-23-02
(15) Circuit breaker 28 V	-	15-216	1Q186	Map ref.D2	24-50-00 R/I	28-23-02
(16) Circuit breaker 28 V	-	15-216	Q1390	Map ref.F6	24-50-00 R/I	28-23-02
(17) Circuit breaker 200/115 V	-	13-215	Q1376	Map ref.E16	24-50-00 R/I	28-23-04
(18) Circuit breaker 28 V	-	15-215	Q188	Map ref.D23	24-50-00 R/I	28-23-04
(19) Circuit breaker 28 V	-	15-216	Q1389	Map ref.C5	24-50-00 R/I	28-23-04
(20) Circuit breaker 28 V	-	3-213	2Q185	Map ref.F5	24-50-00 R/I	28-23-04
(21) Circuit breaker 28 V	-	15-215	2Q186	Map ref.D22	24-50-00 R/I	28-23-04
(22) Circuit breaker 28 V	-	1-213	Q368	Map ref.J13	24-50-00 R/I	28-23-06
(23) Circuit breaker 28 V	-	15-216	Q362	Map ref.D4	24-50-00 R/I	28-23-06
(24) Circuit breaker 28 V	-	3-213	Q367	Map ref.E5	24-50-00 R/I	28-23-06
(25) Circuit breaker 28 V	-	15-215	Q361	Map ref.G19	24-50-00 R/I	28-23-06
(26) Circuit breaker 28 V	-	1-213	Q370	Map ref.J14	24-50-00 R/I	28-23-08
(27) Circuit breaker 28 V	-	15-216	Q364	Map ref.D5	24-50-00 R/I	28-23-08
(28) Circuit breaker 28 V	-	15-215	Q363	Map ref.G20	24-50-00 R/I	28-23-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(29) Circuit breaker 28 V	-	3-213	Q369	Map ref.E6	24-50-00 R/I	28-23-08
(30) Circuit breaker 28 V	-	1-213	Q372	Map ref.J15	24-50-00 R/I	28-23-07
(31) Circuit breaker 28 V	-	15-216	Q366	Map ref.D6	24-50-00 R/I	28-23-07
(32) Circuit breaker 28 V	-	15-215	Q365	Map ref.G21	24-50-00 R/I	28-23-07
(33) Circuit breaker 28 V	-	3-213	Q371	Map ref.E7	24-50-00 R/I	28-23-07
(34) Circuit breaker 28 V	-	15-216	Q373	Map ref.D7	24-50-00 R/I	28-23-05
(35) Circuit breaker 115 V	-	13-216	Q374	Map ref.E4	24-50-00 R/I	28-23-05
(36) LH pump control switch, tank 9	-	2-214	1Q193	3CM station	28-00-00 R/I	28-23-01
(37) RH pump control switch, tank 9	-	2-214	2Q193	3CM station	28-00-00 R/I	28-23-03
(38) LH Pump control switch, tank 10	-	2-214	1Q194	3CM station	28-00-00 R/I	28-23-01
(39) RH pump control switch, tank 10	-	2-214	2Q194	3CM station	28-00-00 R/I	28-23-03
(40) Low pressure caption light module, tank 9 LH	-	2-214	1Q197	3CM station	28-00-00 R/I	28-23-01
(41) Low pressure caption light module,	-	2-214	2Q197	3CM station	28-00-00 R/I	28-23-03

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
tank 9 RH						
(42) Low pressure caption light module, tank 10 LH	-	2-214	1Q198	3CM station	28-00-00 R/I	28-23-01
(43) Low pressure caption light module, tank 10 RH	-	2-214	2Q198	3CM station	28-00-00 R/I	28-23-03
(44) Pump control contactor, tank 9 LH	-	22-123	1Q201	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-23-01
(45) Pump control contactor, tank 9 RH	-	24-123	2Q201	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-23-03
(46) Pump control contactor, tank 10 LH	-	22-123	1Q202	LH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-23-01
(47) Pump control contactor, tank 10 RH	-	24-123	2Q202	RH fuel contactor box, fwd. underfloor racking	28-00-00 R/I	28-23-03
(48) Fuel pump, tank 9 LH	133 AB	-	1Q207	In tank 9	28-23-31 R/I	28-23-01
(49) Fuel pump, tank 9 RH	133 CB	-	2Q207	In tank 9	28-23-31 R/I	28-23-03
(50) Fuel	141 BB	-	1Q208	In tank 10	28-23-31	28-23-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
pump, tank 10 LH					R/I	
(51) Fuel pump, tank 10 RH	141 CB	-	2Q208	In tank 10	28-23-31 R/I	28-23-03
(52) Pressure switch, tank 9 LH	191 HB	-	1Q211	Below tank	28-23-32 R/I	28-23-01
(53) Pressure switch, tank 9 RH	192 HB	-	2Q211	Below tank	28-23-32 R/I	28-23-03
(54) Pressure switch, tank 10 LH	191 QB	-	1Q212	Below tank	28-23-32 R/I	28-23-01
(55) Pressure switch, tank 10 RH	192 QB	-	2Q212	Below tank	28-23-32 R/I	28-23-03
(56) LH pump control switch, tank 11	-	5-214	Q1383	3CM station	28-00-00 R/I	28-23-02
(57) RH pump control switch, tank 11	-	5-214	Q1384	3CM station	28-00-00 R/I	28-23-04
(58) GREEN pump control switch, tank 11	-	5-214	1Q195	3CM station	28-00-00 R/I	28-23-02
(59) BLUE pump control switch, tank 11	-	5-214	2Q195	3CM station	28-00-00 R/I	28-23-04
(60) Low pressure caption light module, tank	-	5-214	Q1391	3CM station	28-00-00 R/I	28-23-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
11 LH						
(61) Low pressure caption light module, tank 11 RH	-	5-214	Q1392	3CMstation	28-00-00 R/I	28-23-04
(62) Low pressure caption light module, tank 11 GREEN	-	5-214	1Q199	3CM station	28-00-00 R/I	28-23-02
(63) Low pressure caption light module, tank 11 BLUE	-	5-214	2Q199	3CM station	28-00-00 R/I	28-23-04
(64) Pump control relay, tank 11 LH	-	24-123	Q1377	RH fuel contactor box, fwd underfloor racking	28-00-00 R/I	28-23-02
(65) Pump control relay, tank 11 RH	-	22-123	Q1378	LH fuel contactor box, fwd. underfloor racking.	28-00-00 R/I	28-23-04
(66) Hydraulic selector valve, tank 11 GREEN	151 DB	-	1Q209	Rear fuse-lage	28-23-41 R/I	28-23-02
(67) Hydraulic selector valve, tank 11 BLUE	151 DB	-	2Q209	Rear fuse-lage	28-23-41 R/I	28-23-04
(68) Fuel pump, tank 11 LH	311 AB	-	Q1379	In tank 11	28-23-53 R/I	28-23-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(69) Fuel pump, tank 11 RH	311 BB	-	Q1380	In tank 11	28-23-53 R/I	28-23-04
(70) Fuel pump (hyd-raulic) motor, tank 11 GREEN	153 FB	-	-	At tank 11	28-23-51 R/I	28-23-02
(71) Fuel pump (hyd-raulic) motor, tank 11 BLUE	153 FB	-	-	At tank 11	28-23-51 R/I	28-23-04
(72) Pressure switch, tank 11 LH	153 FB	-	Q1381	At tank 11	28-23-54 R/I	28-23-02
(73) Pressure switch, tank 11 RH	153 FB	-	Q1382	At tank 11	28-23-54 R/I	28-23-04
(74) Pressure switch, tank 11 GREEN	153 FB	-	1Q213	At tank 11	28-23-52 R/I	28-23-02
(75) Pressure switch, tank 11 BLUE	153 FB	-	2Q213	At tank 11	28-23-52 R/I	28-23-04
(76) Control switch, inlet valve O/RIDE, tank 9 LH	-	2-214	Q375	3CM station	28-00-00 R/I	28-23-06
(77) Control switch, inlet valve O/RIDE, tank 9 RH	-	2-214	Q376	3CM station	28-00-00 R/I	28-23-06
(78) Control switch, inlet valve O/RIDE, tank 11 LH	-	5-214	Q379	3CM station	28-00-00 R/I	28-23-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(79) Control switch, inlet valve O/RIDE, tank 11 RH	-	5-214	Q380	3CM station	28-00-00 R/I	28-23-07
(80) Control switch, inlet valve O/RIDE, tank 5	-	5-214	Q383	3CM station	28-00-00 R/I	28-23-08
(81) Control switch, inlet valve O/RIDE, tank 7	-	5-214	Q385	3CM station	28-00-00 R/I	28-23-08
(82) Control switch, inlet valve, MAIN, tank 9 LH	-	2-214	Q377	3CM station	28-00-00 R/I	28-23-06
(83) Control switch, inlet valve, MAIN, tank 9 RH	-	2-214	Q378	3CM station	28-00-00 R/I	28-23-06
(84) Control switch, inlet valve, MAIN, tank 11 LH	-	5-214	Q381	3CM station	28-00-00 R/I	28-23-07
(85) Control switch, inlet valve, MAIN, tank 11 RH	-	5-214	Q382	3CM station	28-00-00 R/I	28-23-07
(86) Control switch, inlet valve, MAIN, tank 5	-	5-214	Q384	3CM station	28-00-00 R/I	28-23-08
(87) Control switch, inlet valve, MAIN, tank 7	-	5-214	Q386	3CM station	28-00-00 R/I	28-23-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(88) Indicator inlet valve, tank 9 LH	-	2-214	Q390	3CM station	28-00-00 R/I	28-23-06
(89) Indicator inlet valve, tank 9 RH	-	2-214	Q389	3CM station	28-00-00 R/I	28-23-06
(90) Indicator inlet valve, tank 11 LH	-	5-214	Q393	3CM station	28-00-00 R/I	28-23-07
(91) Indicator inlet valve, tank 11 RH	-	5-214	Q394	3CM station	28-00-00 R/I	28-23-07
(92) Indicator inlet valve, tank 5	-	5-214	Q391	3CM station	28-00-00 R/I	28-23-08
(93) Indicator inlet valve, tank 7	-	5-214	Q392	3CM station	28-00-00 R/I	28-23-08
(94) Control relay, inlet valve, tank 9 LH	-	15-123	Q395	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-06
(95) Control relay, inlet valve, tank 9 RH	-	18-123	Q396	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-06
(96) Control relay, inlet valve, tank 11 LH	-	15-123	Q399	LH fuel relay box fwd. underfloor racking	28-00-00 R/I	28-23-07
(97) Control relay, inlet	-	18-123	Q400	RH fuel relay box,	28-00-00 R/I	28-23-07

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
valve, tank 11 LH				fwd. underfloor racking		
(98) Control relay inlet valve, tank 5	-	15-123	Q397	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-08
(99) Control relay inlet valve, tank 7	-	18-123	Q398	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-08
(100) LH level switching pack	-	10-216	Q1350	3CM station RH racking	28-42-51 R/I	28-42-05
(101) RH level switching pack	-	2-216	Q1351	3CM station RH racking	28-42-51 R/I	28-42-07
(102) Inlet valve, tank 9 LH	191 MB	-	Q403	In tank 10	28-23-21 R/I	28-23-06
(103) Inlet valve, tank 9 RH	192 MB	-	Q404	In tank 10	28-23-21 R/I	28-23-06
(104) Inlet valve, tank 11 LH	752	-	Q407	Tank 11, rear bulkhead	28-23-21 R/I	28-23-07
(105) Inlet valve, tank 11 RH	752	-	Q408	Tank 11, rear bulkhead	28-23-21 R/I	28-23-07
(106) Inlet valve, tank 5	193 FB	-	Q405	In tank 5	28-23-21 R/I	28-23-08
(107) Inlet	196 BB	-	Q406	In tank 7	28-23-21	28-23-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
valve, tank 7					R/I	
(108) Fuel forward transfer O/ride control switch	-	4-211	Q388	Pilots' roof panel	28-00-00 R/I	28-23-05
(109) Trim transfer auto master control switch	-	5-214	Q387	3CM station	28-00-00 R/I	28-23-05
(110) Selector load limit control, tanks 9 and 10	-	2-214	Q409	3CM station	28-23-71 R/I	28-23-05
(111) Selector load limit control, tank 11	-	5-214	Q410	3CM station	28-23-71 R/I	28-23-05
(112) Standby 1 CG pack	-	10-216	Q1344	3CM station RH racking	28-44-81 R/I	28-44-07
(113) Standby 2 CG pack	-	9-216	Q1345	3CM station RH racking	28-44-81 R/I	28-44-07
(114) Forward auto trim relay	-	18-123	Q401	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-05
(115) Rearward auto trim relay	-	18-123	Q402	RH fuel relay box, fwd. underfloor racking.	28-00-00 R/I	28-23-05
(116) Rearward auto trim slave relay	-	15-123	Q1385	LH fuel relay box, fwd.	28-00-00 R/I	28-23-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				underfloor racking		
(117) LP warning inhibit relay, tanks 9 and 10	-	15-123	Q1386	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-02
(118) LP fwd. auto trim slave relay	-	15-123	Q1395	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-05
(119) LP warning inhibit relay, tank 11	-	15-123	Q1396	LH fuel relay box fwd. underfloor racking	28-00-00 R/I	28-23-02
(120) De-air pump control switch, tank 11 LH	-	5-214	Q1393	3CM station	28-00-00 R/I	28-23-02
(121) Trim de-air interlock relay	-	18-123	Q1394	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-02
(122) Auto transfer override relay	=	18-123	Q411	RH fuel relay box, fwd. underfloor racking.	28-00-00 R/I	28-23-05
(123) Pump control relay, tank 11, green	-	15-123	1Q205	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-05
(124) Pump	-	18-123	2Q205	RH fuel	28-00-00	28-23-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
control relay, tank 11, blue				relay box, fwd. underfloor racking	R/I	
(125) Pump control relay, tank 9 LH	-	15-123	1Q203	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-01
(126) Pump control relay, tank 9 RH	-	18-123	2Q203	RH fuel relay box, fwd. underfloor racking.	28-00-00 R/I	28-23-03
(127) Pump control relay, tank 10 LH	-	15-123	1Q204	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-01
(128) Pump control relay, tank 10 RH	-	18-123	2Q204	RH fuel relay box fwd. underfloor racking	28-00-00 R/I	28-23-03
(129) LH time delay unit	-	15-123	1Q206	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-01
(130) RH time delay unit	-	18-123	2Q206	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-03
(131) Trim/ refuel C/O relay	-	18-123	Q584	RH fuel relay box, fwd. underfloor	28-00-00 R/I	28-24-07

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
				racking		
(132) Fuel quantity indicator, tank 11	-	5-214	Q1029	Fuel management panel	28-44-83 R/I	28-44-05
(133) Fuel quantity indicator, tank 9	-	2-214	Q1025	Fuel management panel	28-44-83 R/I	28-44-04
(134) Fuel quantity indicator, tank 10	-	2-214	Q1027	Fuel management panel	28-44-83 R/I	28-44-04

R **ON A/C 001-005,

After SB 28-048 For A/C 001-005,

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(135) Pump start control unit, tank 9 LH	123 BB	12-123	1Q1424	Fwd. underfloor racking	28-23-72 R/I	28-23-01
(136) Pump start control unit, tank 9 RH	123 BB	12-123	2Q1424	Fwd. underfloor racking	28-23-72 R/I	28-23-03
(137) Pump start control unit, tank 10 LH	123 BB	12-123	1Q1425	Fwd underfloor racking	28-23-72 R/I	28-23-01
(138) Pump start control unit, tank 10 RH	123 BB	12-123	2Q1425	Fwd. underfloor racking	28-23-72 R/I	28-23-03

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM

Component Identification
Table 101

R **ON A/C 006-007,

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MAINT. TOPIC	WIRING DIAGRAM
(135) Pump start control unit, tank 9 LH	123 BB	12-123	1Q1424	Fwd. underfloor racking	28-23-72 R/I	28-23-01
(136) Pump start control unit, tank 9 RH	123 BB	12-123	2Q1424	Fwd. underfloor racking	28-23-72 R/I	28-23-03
(137) Pump start control unit, tank 10 LH	123 BB	12-123	1Q1425	Fwd underfloor racking	28-23-72 R/I	28-23-01
(138) Pump start control unit, tank 10 RH	123 BB	12-123	2Q1425	Fwd. underfloor racking	28-23-72 R/I	28-23-03

Component Identification
Table 101

END OF THIS SECTION

NEXT

TRIM TRANSFER SYSTEM (FRAMES 72 TO 88) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

CAUTION: OBSERVE THE INSTALLATION REQUIREMENTS FOR SWINGING LINKS AS DETAILED IN PARAGRAPH 1.

OBSERVE THE PIPE COUPLING PRECAUTIONS AND LIMITATIONS AS DETAILED IN PARAGRAPH 2 AND 20-23-12.

1. General

This topic comprises general procedures for the removal and installation of all pipe sections in the transfer system between frames 72 and 88. If removal of a single pipe section is required, the adjoining pipes may have to be moved sufficiently to effect the operation. In this case the appropriate part of these procedures should be followed.

A gap between pipe ends in the couplings, provided for thermal expansion, facilitates the removal and installation of pipes.

When system pipes and couplings are being installed, the general requirements detailed in 20-23-12 and 20-23-21 must be observed.

In the event of damage to the dry lubricant coatings in Gamah-type and compression seal couplings, the procedure for the application of dry lubricant must be in accordance with 20-24-35.

Assembly procedures for compression seal couplings are detailed in paragraph 2. The installation tolerances, detailed in this paragraph, must be observed.

When Gamah couplings (Ref. 20-23-21) are being installed, the pipe gapping tolerances, listed in Table 401, must be observed.

On the illustrations, the pipe sections are identified according to their location in relation to the fuselage frames, e.g., 'Pipe F76-77' indicates the pipe section with its end couplings and/or attachment fittings at or near fuselage frames 76 and 77.

As the jettison piping in tank 11 is connected to the transfer system, it is included in these procedures.

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In tank 11, swinging links and gate links, attaching pipe clips or clamps to the structure, must meet the following requirements:

(1) The link position must be normal to the pipe axis.

(2) The link must be capable of accepting a ±0.2 in (±5 mm) axial movement of the pipe.

(3) Any part of the clip and link assembly must have a minimum clearance of 0.05 in (1.3 mm) from the structure or bracket throughout its movement.

2. Compression Seal Coupling (Ref. Fig.401)

NOTE: This paragraph deals only with the removal/installation of a compression seal coupling. These procedures should be read in conjunction with the appropriate paragraph for the removal/installation of pipes.

A. Remove Coupling

(1) Disengage the circlip from the slots in the sleeve and the nut.

(2) Unscrew the nut fully and disengage it from the sleeve.

(3) Separate the two pipes. Remove and retain the circlip.

(4) Remove the retaining ring from the groove at the pipe end fitting(s).

(5) Remove the spacer(s), O-ring seal(s), sleeve (double coupling), backing ring and nut from the pipe(s).

(6) Fit suitable blanks to the open pipe ends.

B. Prepare to Install Coupling

NOTE: When system pipes and couplings are being installed, the general requirements, as detailed in 20-23-21, must be observed.

(1) Remove the blanks from the open pipe ends.

(2) Using a pencil or masking tape, make a reference mark completely around each end of the pipes to be coupled, at a suitable known distance (Z) (Ref. Fig.401).

NOTE: In the case of light-alloy pipes, the shoulder at the braze may be used as a reference instead of marking.

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(3) Ensure that the pipe end fittings and all components of the coupling are clean and without scratches or damage.

C. Install Coupling

(1) Lubricate the pipe end(s), backing ring, spacer(s), new O-ring seal(s) and the inside of the sleeve in accordance with 20-23-11.

(2) Assemble the nut, backing ring, one O-ring seal and one spacer to the pipe, ensuring that the backing ring is correctly orientated.

(3) Locate the retaining ring securely in the groove at the pipe end.

(4) In the case of a double coupling proceed as follows:

(a) Fit a sleeve, O-ring seal, spacer and retaining ring to the other pipe.

(b) Ensure that the pipes to be coupled are correctly aligned, then interlock the two spacers, locate the O-ring seals against the end faces of the spacers, and slide the sleeve into position.

NOTE: It is recommended that O-ring seals are positioned against the spacers and held in this position during assembly of the sleeve. Ensure that the O-ring seals do not become twisted during assembly.

(5) In the case of a single coupling, proceed as follows:

(a) Fit the pipe end, assembled in operation (2), into the sleeve of the adjoining pipe.

(b) Introduce the spacer and ensure that it is fully inserted into the sleeve before sliding the O-ring seal and backing ring into position.

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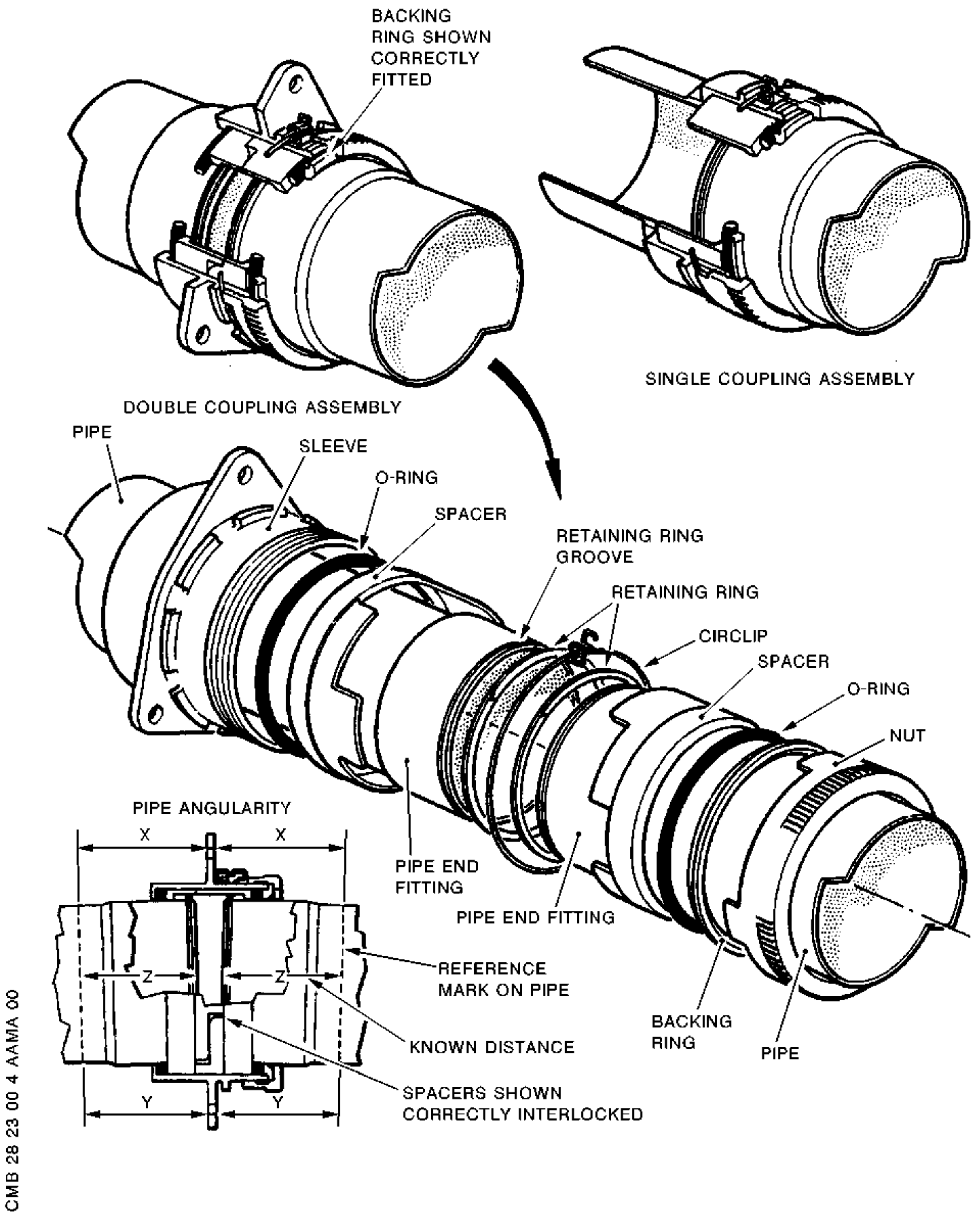

Compression Seal Coupling - Installation
Figure 401 (Sheet 1 of 2)

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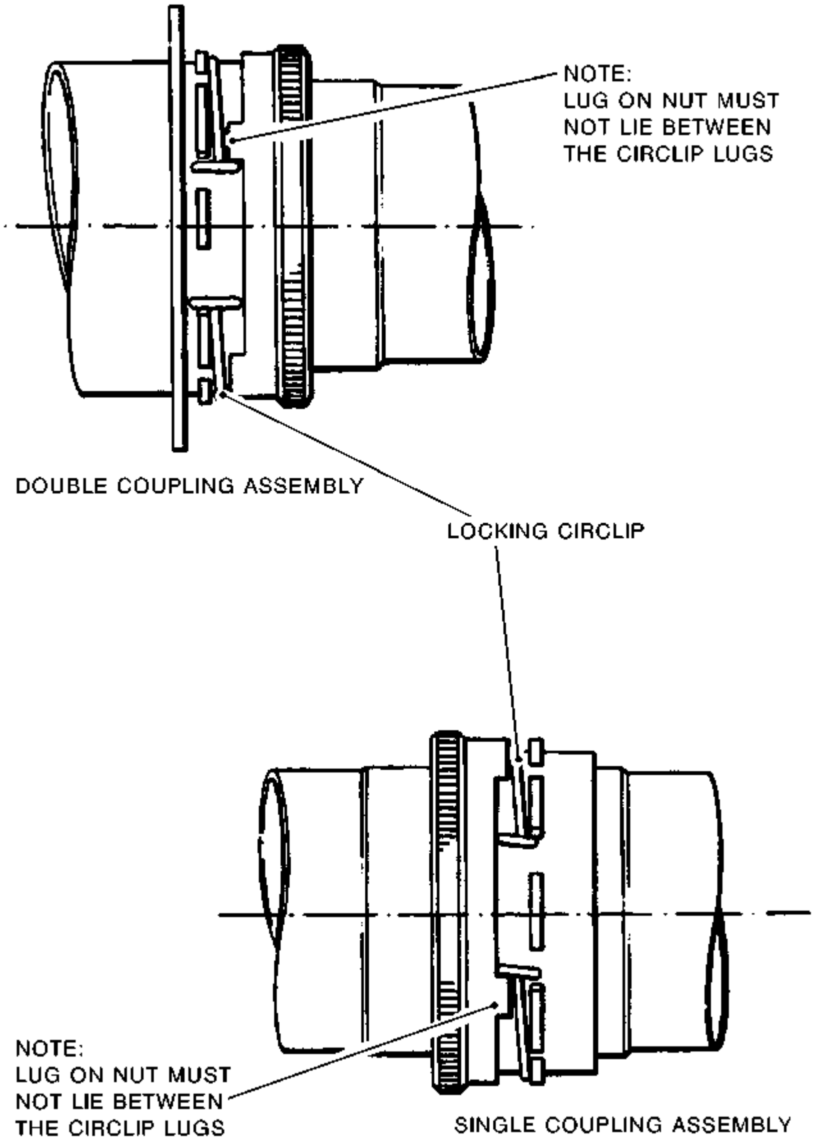

ASSEMBLY OF COMPRESSION SEAL COUPLING
LOCKING CLIP AFTER SERVICE BULLETIN 28-041

CMB 28 23 00 4 AAMB 00

Compression Seal Coupling - Installation
Figure 401 (Sheet 2 of 2)

(6) Using the reference marks, check that the gap between the pipe ends (double coupling), or between the pipe end and pipe shoulder (single coupling), as appropriate, is as follows:

(a) Double coupling:

0.55(±0.15) in (14.0(±3.8) mm)

(b) Single coupling:

0.4(±0.1) in (10.2(±2.5) mm)

(7) Using the reference marks, check that the insertion distance of each pipe end into a double coupling sleeve is 0.275 (±0.75) in (7.0(±1.9 mm).

CAUTION: THE COUPLING NUT MUST BE HAND-TIGHTENED ONLY.

(8) Locate the backing ring against the O-ring seal and assemble the coupling nut, hand-tight only.

(9) Fit a locking circlip so that it engages with a suitable sleeve and nut castellation (these are arranged to provide a vernier adjustment).

(10) Check the pipe angularity (Ref. Fig.401) as follows:

NOTE: The two pipes in a double coupling must be checked independently.

(a) Using a reference mark made at the known distance from the pipe end (Z), measure dimensions X and Y in the plane of maximum angularity, if any, and check that the following equation is satisfied:

X - Y = 0.06 in (1.5 mm) max.

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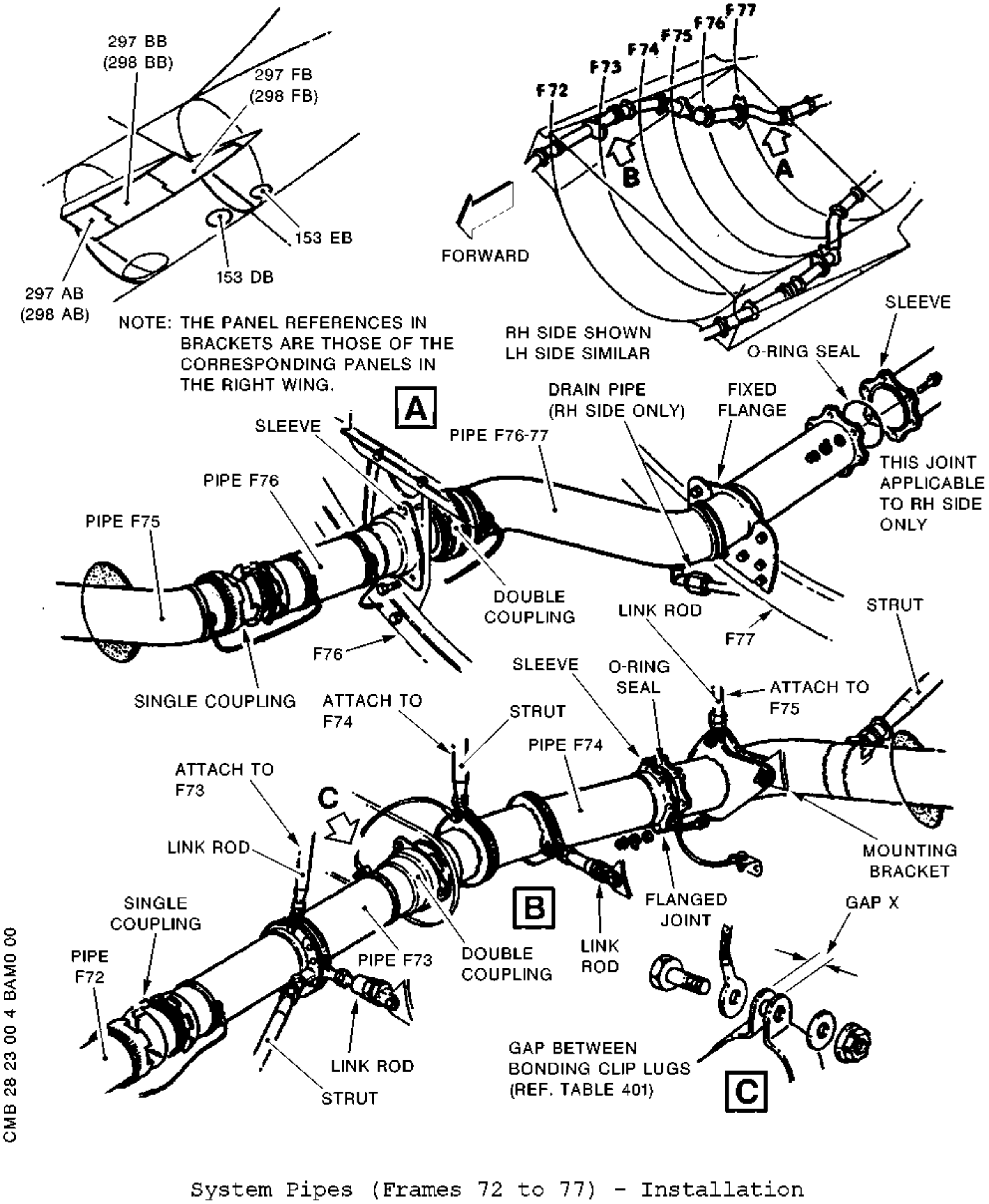

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System Pipes (Frames 72 to 77) - Installation
Figure 402

3. System Pipes (Frames 72 to 77) (Ref. Fig.402)

NOTE: The illustration (Ref. Fig.402) shows the installation of pipe connections and attachment fittings of the RH transfer pipe system between frames 72 and 77. The LP pipe system between these frames is similar, with the exception of a long pipe section fitted between frames 76 and 78. The flanged pipe joint between frames 77 and 78 is therefore not applicable to the LH pipe system.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 41 to 47 lbf in (0.463 to 0.531 mdaN)	-
Torque spanner, 50 lbf in (0.565 mdaN)	-
Torque spanner, 140 lbf in (1.582 mdaN)	-
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Container, 10 gal (45 l), for fuel spillage	-

B. Prepare to Remove Pipes (Frames 72 to 77)

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(3) Drain the fuel from the trim transfer pipes as follows:

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(a) Position a 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that may drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN valves switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the SCAVENGE PUMP indicator displays OFF; then set the TRIM PIPE DRAIN valves switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT"; wait until the associated magnetic indicators display bar-across-line, and then set the switches to "OFF".

(f) Remove the container.

(4) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

(5) Open the appropriate access panels (Ref. Fig.402).

C. Remove Pipes (Frames 72 to 77)

(1) At panel 153 DB, release the coupling nuts (Ref. para.2.) at each end of the short pipe at frame 76.

(2) From the pipe at frame 76, disconnect the two bonding leads.

(3) At frame 76, remove the three split pins, nuts, washers and bolts which secure the double coupling sleeve to the mounting bracket.

(4) Slide the short pipe at frame 76 rearward to its full extent so that the pipe ends at the frame are fully compressed within the coupling sleeve.

(5) At the wing bottom surface, disconnect the pipe flanged joint forward of frame 75 by removing the locking wire and the six nuts, bolts, countersunk washers, shouldered washers, retaining clips and the bonding lead.

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(6) From the pipe near frame 75, disconnect the strut and link rod by removing the split pins, nuts, washers and bolts securing the strut and link rod to the pipe fittings. Remove the split pin, nut, washer and bolt securing the pipe fitting to a mounting bracket on the frame.

(7) Slide the pipe at frame 75 rearward and disengage it from the sleeve at the forward flanged joint. Remove the pipe, then remove and discard the O-ring seal from the forward end of the pipe.

(8) From the pipe at frame 74, disconnect the strut and link rod by removing the split pins, nuts, washers and bolts securing the strut and link rod to the pipe fittings.

(9) Unscrew the nut and release the double coupling (Ref. para.2.) forward of frame 74. Withdraw the pipe at frame 74 from the coupling and remove the pipe.

(10) From the pipe at frame 73, disconnect the two link rods and the strut by removing the split pins, nuts, washers and bolts securing the rods and strut to the pipe fitting.

NOTE: If this pipe is being renewed, it will also be necessary to remove the split pins, nuts, washers, bolts and distance pieces securing the rod attachment bracket to the pipe fitting. The rod attachment bracket and its attaching parts must be retained.

(11) At the double coupling forward of frame 74, remove the three split pins, nuts, washers and bolts securing the coupling sleeve to the mounting bracket.

(12) Remove the bonding lead attachment from the forward end of the pipe at frame 73.

(13) Unscrew the nut and release the single coupling (Ref. para.2.) securing the forward end of the pipe between frames 72 and 73. Withdraw the pipe at frame 73 from the coupling and remove the pipe.

(14) At panel 153 DB, withdraw the short pipe at frame 76 from the double coupling at its rear end and remove the pipe.

(15) At the pipe connection between frames 77 and 78 (RH side only), disconnect the flanged joint by removing the locking wire, and the six nuts, bolts, countersunk washers, shouldered washers and retaining clips.

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(16) From the pipe at frames 76-77, unscrew the union nut and disconnect the drain pipe (RH side only).

(17) At frame 77, remove the two split pins, nuts, washers and bolts securing the fixed flange of the pipe to the mounting bracket on the frame. Remove the pipe at frames 76-77.

(18) Remove from the pipes the pipe coupling components (Ref. para.2.).

(19) Fit suitable blanks to all open pipe ends and the drain pipe connection.

D. Prepare to Install Pipes (Frames 72 to 77)

(1) Remove the blanks from the open pipe ends and the drain pipe connection.

(2) Ensure that all pipe end fittings and attaching parts are clean and without scratches or damage.

(3) Assemble the compression seal coupling components on the pipe ends (Ref. para.2.).

E. Install Pipes (Frames 72 to 77)

GAP X, WITH LUGS HELD TOGETHER BY FINGER PRESSURE	SPACING WASHER(S) TO BE FITTED BETWEEN LUGS	
	WASHER	QTY.
0.010 to 0.059 in (0.254 to 1.498 mm)	-	0
0.060 to 0.119 in (1.524 to 3.022 mm)	Y	1
0.120 to 0.169 in (3.048 to 4.292 mm)	Z	1
0.170 to 0.209 in (4.318 to 5.308 mm)	Y and Z	1 of each

NOTE: Washer Y thickness: 0.048 in (1.219 mm)

Washer Z thickness: 0.104 in (2.641 mm)

Bonding Clip Lug Gap and Spacing Washers (Ref. Fig.402)
Table 401

CAUTION: DURING INSTALLATION OF PIPES AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

NOTE: Split pins are to be fitted, as required, in accordance with 20-21-12.

(1) Observe the fuel and electrical safety precautions.

(2) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the rearward end of the pipe which fits to frames 76 and 77 (RH side only).

(3) Position the pipe at frames 76-77 and insert the rearward end into the adjoining pipe sleeve. At frame 77, the fixed flange on the pipe must be positioned on the aft face of the mounting bracket.

(4) Secure the fixed flange on the pipe to the mounting bracket at frame 77 with two bolts, washers and nuts. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(5) Secure the flanged pipe joint aft of frame 77 (RH side only) with six bolts, countersunk washers, shouldered washers, retaining clips and nuts. Torque-tighten each bolt to between 41 and 47 lbf in (0.463 and 0.531 mdaN). Wire-lock the bolt heads in pairs and the clips in pairs in accordance with 20-21-13.

(6) Secure the drain pipe to the transfer pipe with the union nut. Torque-tighten the nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

(7) Reposition the bonding clip on the pipe aft of frame 76. Determine the quantity and thickness of the spacing washers to be fitted between the lugs as detailed in Table 401 (Ref. Fig.402). Connect the bonding leads in accordance with 20-27-11, using the bolt, washer and nut. Torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(8) Position the short pipe at frame 76 with the flange on the double coupling sleeve on the forward face of the mounting bracket at the frame.

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(9) Secure the double coupling sleeve to the mounting bracket at frame 76 with three bolts, washers and nuts. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(10) At frame 76, fit and secure the double coupling (Ref. para.2.).

(11) Reposition the two bonding clips on the short pipe at frame 76. Determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig.402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts. Torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(12) Position the pipe at frame 75, inserting it, from the access panel aperture in the bottom of the wing, through the aperture in the fuselage skin.

(13) Secure the pipe fitting at frame 75 to the mounting bracket on the fuselage with the bolt, washer and nut. Torque-tighten the nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(14) Check that the pipes are correctly aligned (Ref. para.2.) at the single coupling between frames 75 and 76. Fit and secure the coupling.

(15) Adjust the link rod and strut near frame 75 if necessary, then torque-tighten and secure the locknuts as follows:

(a) 1/4 in (6.35 mm) dia. rod-end locknut to 50 lbf in (0.565 mdaN).

(b) 1/2 in (12.7 mm) dia. rod-end locknut to 140 lbf in (1.582 mdaN).

(c) Wire-lock each locknut to its serrated locking plate in accordance with 20-21-13.

(16) Secure the strut and link rod to the pipe fittings near frame 75 with the bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(17) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the forward end of the pipe at frame 75.

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(18) Position the pipe at frame 74 and secure the flange at the rearward end of the pipe to that of the adjoining pipe with the six bolts, countersunk washers, shouldered washers, retaining clips and nuts, ensuring that the bonding lead is correctly positioned behind the appropriate bolt head. Torque-tighten each bolt to between 41 and 47 lbf in (0.463 and 0.531 mdaN). Wire-lock the bolt heads in pairs and the clips in pairs in accordance with 20-21-13.

(19) Adjust the link rod and strut at frame 74 if necessary, then torque-tighten and secure the locknuts as follows:

(a) 1/4 in (6.35 mm) dia. rod-end locknut to 50 lbf in (0.565 mdaN).

(b) 1/2 in (12.7 mm) dia. rod-end locknut to 140 lbf in (1.582 mdaN).

(c) Wire-lock each locknut to its serrated locking plate in accordance with 20-21-13.

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(20) Secure the link rod and strut to the pipe fittings near frame 74 with the bolts, washers and nuts, attaching the bonding lead behind the strut bolt head. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(21) Position the pipe at frame 73, checking the coupling alignment at each end (Ref. para.2.). At the rearward end of the pipe, secure the flanged sleeve of the double coupling to the forward face of the mounting bracket with the three bolts, washers and nuts. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(22) Fit and secure the double coupling (Ref. para.2.) at the rearward end of the pipe, forward of frame 74.

(23) Fit and secure the single coupling (Ref. para.2.) at the forward end of the pipe, aft of frame 72.

(24) Reposition the bonding clips at each end of the pipe at frame 73. Determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig.402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts. Torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(25) Adjust the link rods and strut at frame 73 if necessary, then torque-tighten and secure the locknuts as follows:

(a) 1/4 in (6.35 mm) dia. rod-end locknut to 50 lbf in (0.565 mdaN).

(b) 1/2 in (12.7 mm) dia. rod-end locknut to 140 lbf in (1.582 mdaN).

(c) Wire-lock each locknut to its serrated locking plate in accordance with 20-21-13.

(26) Secure the strut and the two link rods to the pipe fitting at frame 73 with bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

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F. Conclusion

(1) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(2) Carry out a Leakage Test of the disturbed piping (Ref. 28-23-00, Adjustment/Test).

(3) Fit/close the access panels in accordance with 53-00-00 and 57-00-00, Removal/Installation).

4. System Pipes (Frame 78 to 81) (Ref. Fig.403)

NOTE: The illustration (Ref. Fig.403) shows the installation of pipe connections and attachment fittings of the LH transfer pipe system between frames 78 and 81. The RH pipe system is similar.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 30 to 40 lbf in (0.339 to 0.452 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-

DESCRIPTION	PART NO.
Torque spanner, 150 to 250 lbf in (1.695 to 2.825 mdaN)	-
Container, 10 gal (45 l), for fuel spillage	-

B. Prepare to Remove Pipes (Frames 78 to 81)

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(3) Drain the fuel from the trim transfer pipes as follows:

(a) Position a 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN valves switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN valves switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, and then set the switches to "OFF".

(f) Remove the container.

(4) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

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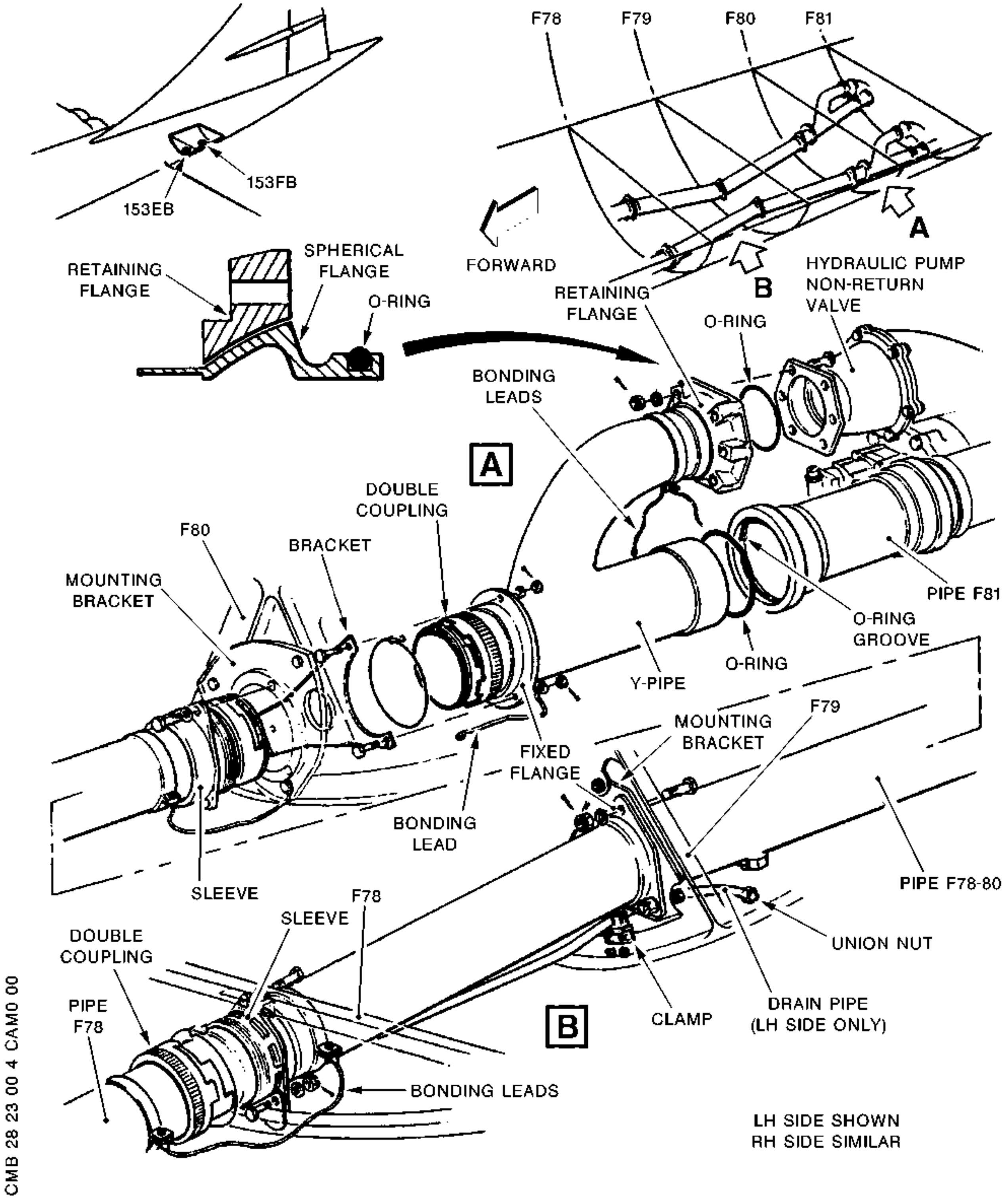

System Pipes (Frames 78 to 81) - Installation
Figure 403

(5) Open the appropriate access panels (Ref. Fig.403).

WARNING: OBSERVE THE HYDRAULIC SAFETY PRECAUTIONS DETAILED IN 29-00-00.

(6) Remove the hydraulic pump element (Ref. 28-23-51, Removal/Installation).

(7) Remove sections of hydraulic piping as necessary, to facilitate subsequent removal of the trim transfer Y-pipe.

C. Remove Pipes (Frames 78 to 81)

(1) At panel 153 EB, frame 78, unscrew and release the nut of the double coupling (Ref. para.2.).

(2) Remove the bolts, washers, split pins and nuts which secure the double coupling sleeve.

(3) At frame 79, remove the bolts, nuts, washers and split pins securing the fixed flange to the mounting bracket.

(4) At panel 153 FB, frame 80, remove the bolts, washers, nuts and split pins securing a bracket to a fixed flange of the Y-pipe and the structure. Remove the bracket.

(5) Disconnect the double coupling (Ref. para.2.) at frame 80 and remove the bolts securing the coupling sleeve to the mounting bracket.

(6) Disconnect the bonding leads attached to the Y-pipe.

(7) Remove the bolts, washers, nuts and split pins securing the retaining flange of the Y-pipe to the hydraulic non-return valve.

(8) Disconnect the drain pipe connection near frame 79 (LH side only) by unscrewing the union nut and also the nuts securing the pipe to the clamp.

(9) Slide the angled pipe, located between frames 78 and 80, forward to its full extent, so that the pipe ends at frame 78 are fully compressed within the coupling sleeve.

(10) Slide the Y-pipe forward, toward the angled pipe, until it is disengaged from the pump non-return valve and the short pipe at frame 81.

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(11) Remove the Y-pipe and remove and discard the two O-ring seals.

NOTE: Removal of the Y-pipe is necessary for removal of a hydraulic pump canister (Ref. 28-23-51, Removal/installation).

(12) At frame 78, disconnect the bonding lead from the bonding clip on the pipe.

(13) Remove the bolts, nuts, washers and split pins securing the mounting brackets to the structure at frames 79 and 80.

(14) Remove the angled pipe between frames 78 and 80.

(15) Remove the double coupling components from the pipes (Ref. para.2.).

(16) Fit suitable blanks to the open pipe ends and pump non-return valve.

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D. Prepare to Install Pipes (Frames 78 to 81)

(1) Remove the blanks from the open pipe ends and pump non-return valve.

(2) Ensure that all pipe end fittings and attaching parts are clean and without scratches or damage.

(3) Assemble the compression seal coupling components on the pipe ends (Ref. para.2.).

E. Install Pipes (Frames 78 to 81)

CAUTION: DURING INSTALLATION OF PIPES, COMPONENTS AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

NOTE: Split pins are to be fitted, as required, in accordance with 20-21-12.

(1) Observe the fuel and electrical safety precautions.

(2) Position the angled pipe between frames 78 and 80 with the mounting brackets at frames 79 and 80 correctly positioned in relation to the structure.

(3) Secure the mounting bracket to the structure at frame 79 with the bolts, washers, nuts and split pins. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN).

(4) Secure the other mounting bracket to the structure at frame 80 with the bolts, washers, nuts and split pins, ensuring that the distance pieces and the bonding lead are correctly positioned. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN).

(5) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the groove in the spherical flange of the Y-pipe and the groove in the short pipe at frame 81.

(6) Slide the Y-pipe into the short pipe and into the pump non-return valve, ensuring that the O-ring seals remain correctly positioned in their grooves.

(7) Secure the Y-pipe retaining flange to the flange on the pump non-return valve, holding the spherical flange on the pipe firmly forward against the retaining flange. Fit the six bolts, washers, nuts and split pins, torque-tightening each nut, in diametrically opposite sequence, to between 12 and 15 lbf in (0.136 and 0.269 mdaN).

(8) Secure the fixed flange of the angled pipe at frame 79 with the bolts, washers, nuts and split pins, torque-tightening each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN).

(9) At frame 78, secure the double coupling sleeve to the structure with:

(a) the top bolt and washer, torque-tightening the bolt to between 30 and 40 lbf in (0.339 and 0.452 mdaN), and

(b) the two bottom bolts, washers, nuts and split pins, torque-tightening each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN).

(10) At frame 80, secure the double coupling sleeve to the mounting bracket with the bolts and washers, torque-tightening each bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(11) Secure the drain pipe to the transfer pipe with the union nut, torque-tightening the nut to between 150 and 250 lbf in (1.695 and 2.825 mdaN).

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(12) Secure the drain pipe clamp.

(13) Install the double couplings (Ref. para.2.) at frames 78 and 80.

(14) Secure the bracket, which attaches the fixed flange of the Y-pipe to the structure at frame 80, with the bolts, washers, nuts and split pins, torque-tightening each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN).

(15) Reposition the bonding clips on the pipe at frame 78 and the Y-pipe. Determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig.402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts. Torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(16) Check that all electrical bonding is installed in accordance with 20-27-11.

F. Conclusion

(1) Refit the hydraulic pipes.

(2) Install the hydraulic pump element (Ref. 28-23-51, Removal/Installation).

(3) Cancel the electrical safety precautions (Ref. 24-00-00) and remove the warning notices.

(4) Carry out a Leakage Test of the disturbed fuel and hydraulic piping (Ref. 28-23-00, Adjustment/Test and 29-00-00, Inspection/Check).

(5) Close the access panels 153 EB and 153 FB.

5. System Pipes (Tank 11) (Ref. Fig.404)

NOTE: Removal and installation procedures are detailed for all trim transfer and jettison pipe sections in the tank, commencing with the RH system from the tank forward bulkhead (frame 81) to the rear bulkhead (frame 88), followed by similar coverage of the LH system.

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A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 12 to 15 lbf in (0.136 to 0.169 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 74 to 80 lbf in (0.836 to 0.904 mdaN)	-
Torque spanner, 80 to 90 lbf in (0.904 to 1.017 mdaN)	-
Torque spanner, 100 to 120 lbf in (1.130 to 1.356 mdaN)	-
Container, 10 gal (45 l) for fuel spillage	-

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B. Prepare to Remove Pipes (Tank 11)

(1) Defuel and drain the tank (Ref. 28-25-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

<u>CAUTION</u>: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(4) Drain the fuel from the trim transfer pipes as follows:

(a) Position a 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that may drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN valves switches to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as the fuel drains into the scavenge tank.

(d) Wait until the SCAVENGE PUMP indicator displays OFF, then set the TRIM PIPE DRAIN valves switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, and then set the switches to "OFF".

(f) Remove the container.

(5) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

(6) Remove the tank access panel 311 CB.

(7) Prepare the tank for entry (Ref. 28-10-00, Servicing).

C. Remove RH System Pipes (Tank 11)

NOTE: All O-ring seals must be removed and discarded from the removed pipe sections.

These procedures assume that all pipes are installed.

(1) Detach the bonding leads where necessary in order to effect pipe removal, noting the position of attaching parts.

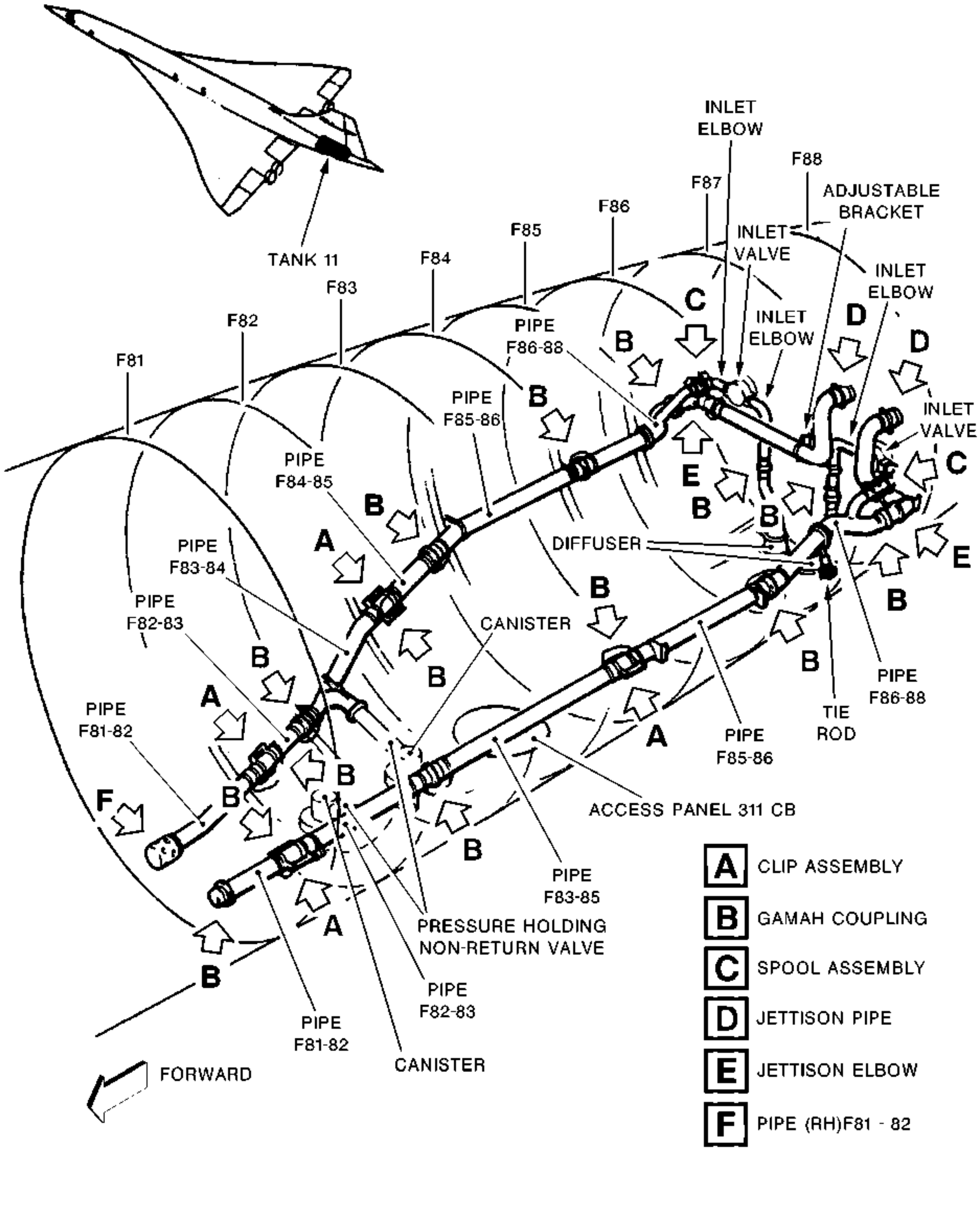
(2) Remove the short pipe (RH) at frames 82-83 as follows:

(a) Remove the clip assembly (Detail A) and release the Gamah couplings (Detail B).

(b) From the pipe (RH) at frames 81-82, remove the split pin, nut, special bolt and washer securing the pipe pivot block to a mounting bracket on frame 82.

(c) Slide the pipe (RH) at frames 81-82 forward into the coupling at the bulkhead (Detail F). Remove the short pipe (RH) at frames 82-83.

(3) Remove the pipe (RH) at frames 81-82 following operation (2), by carefully withdrawing it from the pipe coupling on the tank forward bulkhead.



System Pipes (Tank 11) - Installation
Figure 404 (Sheet 1 of 3)

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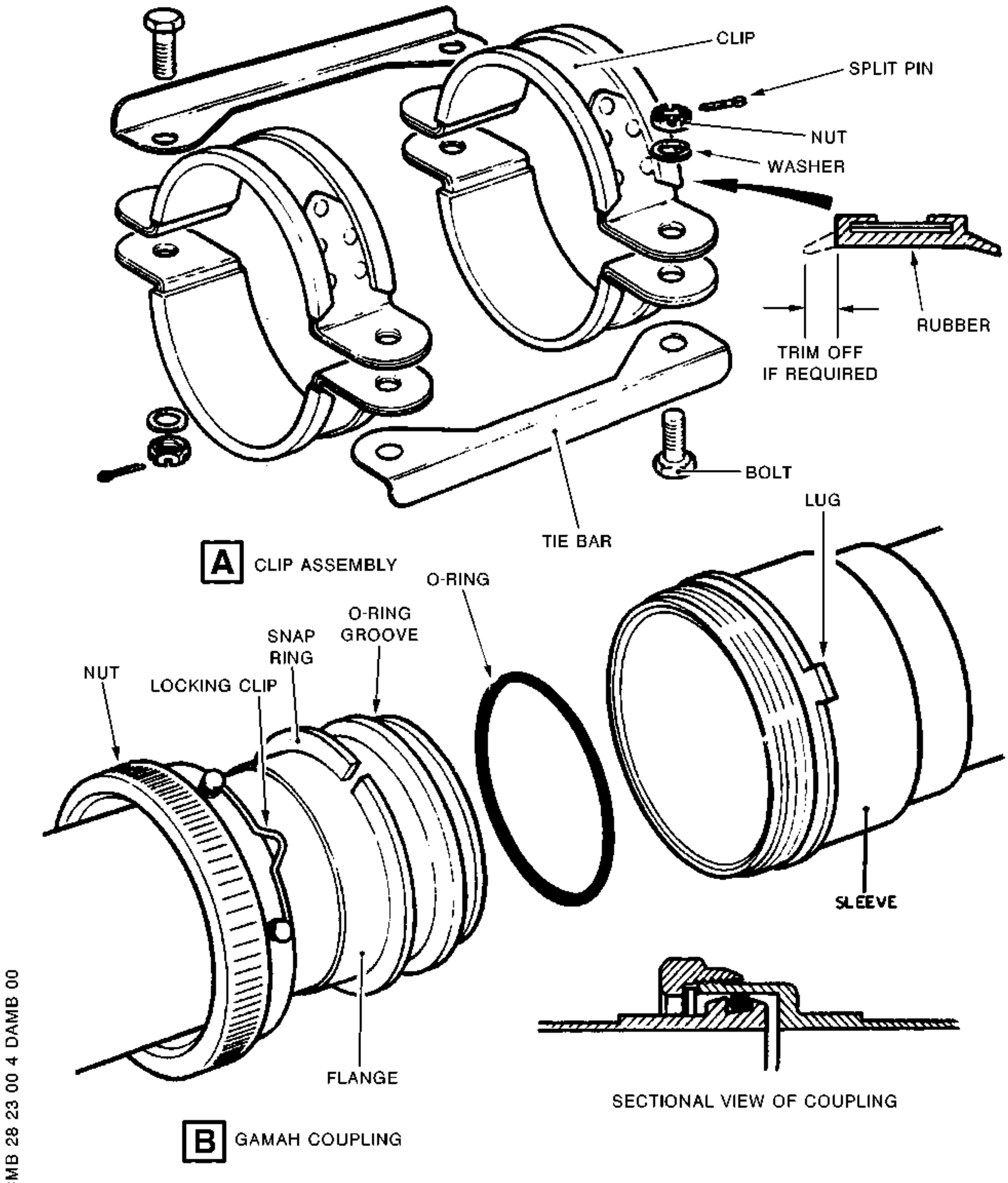
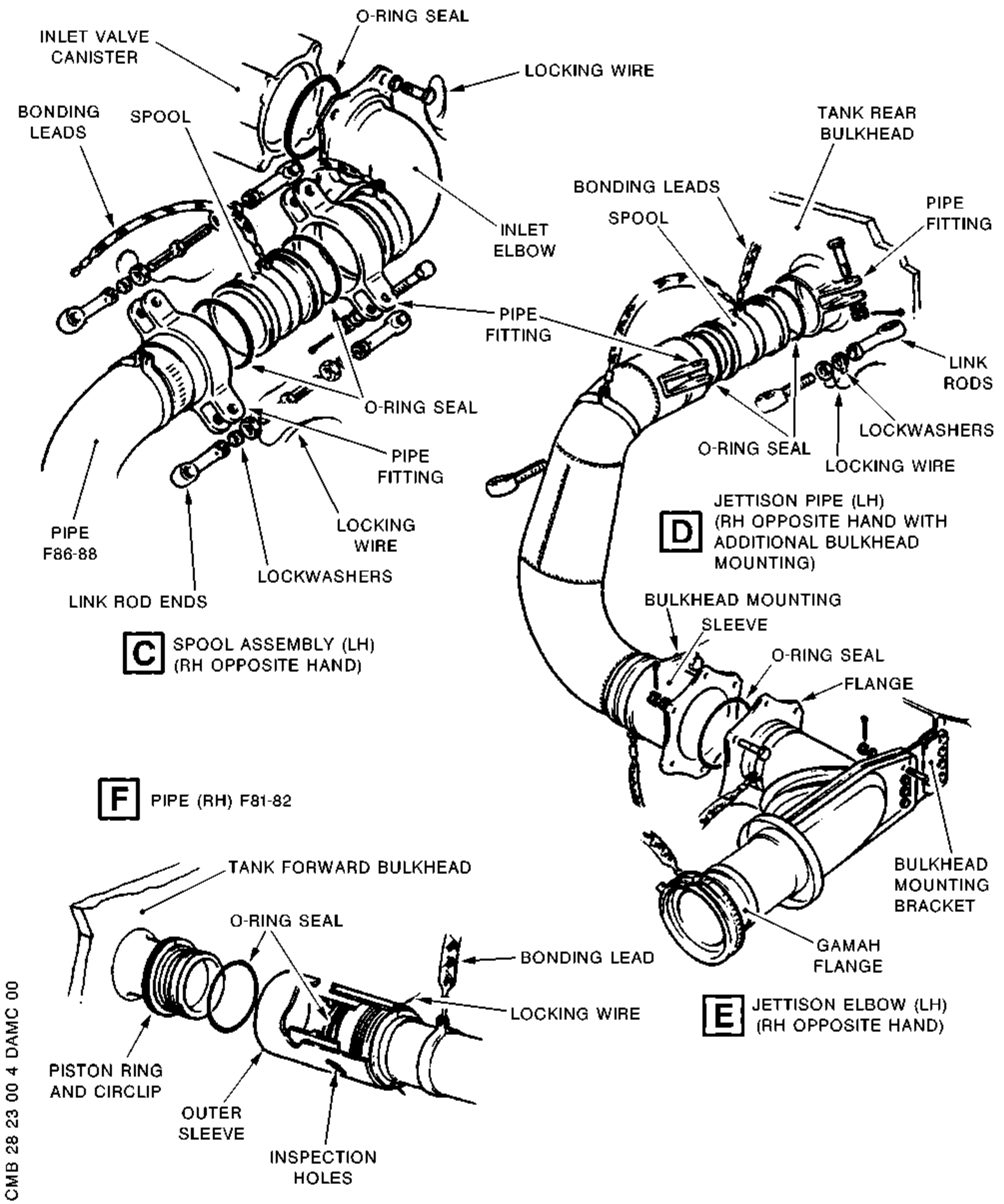


System Pipes (Tank 11) - Installation
Figure 404 (Sheet 2 of 3)



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System Pipes (Tank 11) - Installation
Figure 404 (Sheet 3 of 3)

(4) Remove the pipe from the tank and disassemble the coupling (Detail F) as follows:

(a) Remove the inner sleeve.

(b) Remove the locking wire and unscrew the outer sleeve.

(5) Remove the stainless steel pipe (RH) at frames 83-84 as follows:

(a) Remove the locking wire and the four bolts, washers, clips and nuts securing the pipe to the pressure holding non-return valve (Ref. 28-23-55, Removal/Installation).

(b) At frame 83, remove the four split pins, nuts, bolts and washers securing the top half of the pipe clamp. Remove the half clamp.

(c) From the short pipe (RH) at frames 84-85, remove the clip assembly (Detail A) and release the Gamah couplings (Detail B). Slide the pipe rearward.

(d) At frame 84, detach the pipe fitting from the mounting bracket by removing the two split pins, nuts, washers, shim washers and bolts. Note the number and position of the shim washers then remove the pipe.

(6) Remove the short pipe (RH) at frames 84-85 as follows:

NOTE: The following operations are necessary if the stainless steel pipe (RH) at frames 83-84 has not been removed.

(a) Remove the clip assembly (Detail A) and release the Gamah couplings (Detail B).

(b) At the rearward end of the pipe (RH) at frame 85-86, release the Gamah coupling (Detail B).

(c) At frame 85, detach the pipe fitting from the mounting bracket by removing the two split pins, nuts, washers, shim washers and bolts. Note the position and number of the shim washers.

(d) At frame 86, remove the two split pins, nuts and washers securing the top half of the pipe clip. Remove the half clip.

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(e) Slide the pipe (RH) at frames 85-86 rearward so that the pipe ends in the Gamah sleeve are compressed. Remove the short pipe (RH) at frames 84-85.

(7) Remove the pipe (RH) at frames 85-86 by carefully withdrawing it from the Gamah coupling at the rearward end.

(8) Remove the Y-pipe (RH) at frames 86-88 as follows:

(a) Release the Gamah coupling (Detail B) at the jettison elbow (Detail E).

(b) At the pipe fitting to the spool assembly (Detail C), remove the split pins, nuts, bolts and washers securing the link rod ends to the pipe fitting.

(c) At frame 87, remove the split pin, nut, bolt and washer securing the pipe fitting to the tie rod. Remove the Y-pipe (RH) at frames 86-88.

(9) Remove the inlet elbow (RH) (Detail C), upstream of the inlet valve, as follows:

(a) Remove the locking wire, four bolts and washers securing the pipe elbow to the inlet valve canister.

(b) Remove the split pins, nuts, bolts and washers securing the link rod ends to the pipe fitting.

(c) Slide the inlet elbow toward the spool to disengage it from the canister. Remove the inlet elbow.

(10) Remove the inlet elbow (RH), downstream of the inlet valve as follows:

(a) Remove the locking wire, four bolts and washers securing the inlet elbow to the inlet valve canister.

(b) Release the Gamah coupling at the other end of the inlet elbow, disengage the pipe elbow from the canister and remove it.

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(11) Remove the diffuser and short pipe (RH) as follows:

(a) At the lower end of the diffuser, remove the split pins, nuts and washers securing the pipe half clip. Remove the half clip.

(b) At the upper end of the diffuser, release the clip assembly by removing the four split pins, nuts, bolts and washers.

(c) Release the Gamah couplings (Detail B) and remove the diffuser and short pipe.

(12) Remove the jettison pipe (Detail D) as follows:

(a) At the flanged joint connecting the pipe to the jettison elbow, remove the six split pins, nuts, bolts and washers.

(b) Disconnect the two link rods attached to the pipe fitting by removing the two split pins, nuts, bolts and washers.

(c) Disconnect the pipe fitting from the mounting pillar on the rear bulkhead by removing the two split pins, nuts, bolts and washers.

(d) Remove the locking wire, two bolts and tabwashers securing the pipe trunnion to the rear bulkhead mounting bracket. Remove the jettison pipe.

(13) Remove the jettison elbow (Detail E) as follows:

(a) Release the Gamah coupling (Detail B).

(b) Disconnect the elbow from the bulkhead mounting bracket by removing the four split pins, nuts, bolts and washers securing the pipe fitting to the bracket joint plate.

(14) Remove the Gamah coupling components (Detail B) from the pipes.

(15) Fit suitable blanks to all apertures.

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D. Remove LH System Pipes (Tank 11)

NOTE: All O-ring seals must be removed and discarded from removed pipe sections.

These procedures assume that all pipes are installed.

(1) Detach the bonding leads where necessary in order to effect pipe removal, noting the position of attaching parts.

(2) Remove the short pipe (LH) at frames 81-82 as follows:

(a) Remove the clip assembly (Detail A) and release the Gamah couplings (Detail B).

(b) Slide the pipe forward toward the bulkhead, turn it at an angle to clear the rearward coupling and carefully withdraw it from the bulkhead coupling.

(3) Remove the stainless steel pipe (LH) at frames 82-83 as follows:

(a) Remove the locking wire and the four bolts, washers, clips and nuts securing the pipe to the pressure holding non-return valve (Ref. 28-23-55, Removal/Installation).

(b) Release the Gamah coupling (Detail B) at the rearward end of the pipe.

(c) At frame 82, remove the four split pins, nuts, bolts and washers securing the top half of the pipe clamp. Remove the half clamp.

(d) At frame 83, remove the two split pins, nuts, bolts, washers and shim washers securing the pipe fitting to the frame. Note the position and number of the shim washers then remove the pipe.

(4) Remove the pipe (LH) at frames 83-85 as follows:

NOTE: The following operations are necessary if the stainless steel pipe (LH) at frames 82-83 has not been removed.

(a) Remove the clip assembly (Detail A) and release the Gamah couplings (Detail B).

(b) At the rearward end of the pipe at frames 85-86, release the Gamah coupling (Detail B).

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(c) At frame 85, detach the pipe fitting from the mounting bracket by removing the two split pins, nuts, bolts, washers and shim washers. Note the position and number of the shim washers.

(d) At frame 86, remove the two split pins, nuts and washers securing the top half of the pipe clip. Remove the half clip.

(e) Slide the pipe (LH) at frames 85-86 rearward so that the pipe ends in the Gamah sleeve are compressed. Remove the pipe (LH) at frames 83-85.

(5) Remove the pipe (LH) at frames 85-86 by carefully withdrawing it from the Gamah coupling at the rearward end.

(6) Remove the Y-pipe (LH) at frames 86-88 as follows:

(a) Release the Gamah coupling (Detail B) at the jettison elbow (Detail E).

(b) At the pipe fitting to the spool assembly (Detail C), remove the split pins, nuts, bolts and washers securing the link rod ends to the pipe fitting.

(c) At frame 87, remove the split pin, nut, bolt and washer securing the pipe fitting to the tie rod. Remove the Y-pipe (LH) at frames 86-88.

(7) Remove pipes (LH) attaching to frame 88 as detailed for the similar, but opposite-handed, pipes in the RH system (Ref. paras.C.(9) to (13)).

(8) Remove the Gamah coupling components (Detail B) from the pipes.

(9) Fit suitable blanks to all apertures.

E. Prepare to Install Pipes (Tank 11)

<u>CAUTION</u>: DURING INSTALLATION OF PIPES AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

SWINGING LINKS, WHICH ATTACH PIPE CLIPS (CLAMPS) TO THE STRUCTURE, MUST MEET THE INSTALLATION REQUIREMENTS DETAILED IN PARAGRAPH 1.

CAPPING TOLERANCES MUST BE MET IN ACCORDANCE WITH TABLE 402.

(1) Note the gapping tolerance requirements at the pipe couplings in accordance with Table 402.

PIPE*	SIDE	COUPLING POSITION	NEAREST FRAME NO.	GAP (in)	(mm)
F82-83	RH	Forward	82	0.2(±0.02)	5.1(±0.5)
F82-83	RH	Aft	83	0.5(±0.2)	12.7(±5.1)
F84-85	RH	Forward	84	0.2(±0.02)	5.1(±0.5)
F84-85	RH	Aft	85	0.5(±0.2)	12.7(±5.1)
F85-86	RH	Aft	86	0.6(±0.1)	15.2(±2.5)
F86-88	RH	Aft	87	0.2(±0.1)	5.1(±2.5)
Inlet elbow	RH	Bottom	88	0.2(±0.1)	5.1(±2.5)
Diffuser	RH	Top	88	0.2(±0.02)	5.1(±0.5)
F81-82	LH	Forward	81	0.5(+0.2 -0.1)	12.7(+5.1 -2.5)
F81-82	LH	Aft	82	(0.2(±0.02)	5.1(±0.5)
F83-85	LH	Forward	83	0.5(+0.2 -0.1)	12.7(+5.1 -2.5)
F83-85	LH	Aft	85	0.2(±0.02)	5.1(±0.5)
F85-86	LH	Aft	86	0.6(±0.1)	15.2(±2.5)
F86-88	LH	Aft	87	0.2(±0.1)	5.1(±2.5)
Inlet elbow	LH	Bottom	88	0.2(±0.1)	5.1(±2.5)
Diffuser	LH	Top	88	0.2(±0.02)	5.1(±0.5)

*Pipe 'F' Nos. are quoted on illustrations, where applicable

Gapping Tolerances between Pipe Ends
at Gamah Couplings (Tank 11)
Table 402

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(2) Remove the blanks from the apertures.

(3) Ensure that all pipe end fittings and attaching parts are clean and without scratches or damage.

(4) Assemble the Gamah coupling components, as required, on the pipe ends (Ref. 20-23-21 and Detail B).

F. Install RH System Pipes (Tank 11)

NOTE: These procedures assume that all pipes are removed.

Gamah couplings are to be installed in accordance with 20-23-21.

Split pins are to be fitted, as required, in accordance with 20-21-12.

All O-ring seals are to be lubricated in accordance with 20-23-11.

Wire-locking, as required, is to be in accordance with 20-21-13.

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(1) Observe the fuel (28-00-00) and electrical (24-00-00) safety precautions.

(2) Install the pipe (RH) at frames 81-82 as follows:

NOTE: This pipe is secured to the structure by its pivot block which is attached by a special bolt to a mounting bracket on frame 82. Before final assembly of the pipe forward coupling (Detail F), the bolt-hole alignment of the pivot block and mounting bracket should be checked. If alignment with the coupling on frame 81 is required, loosen the bolt securing the pivot block to the pipe fitting. After alignment, torque-tighten the bolt to between 100 and 120 lbf in (1.130 and 1.356 mdaN) and lock it with the tabwasher in accordance with 20-21-17.

(a) Assemble the forward bulkhead coupling components (Detail F) to the pipe as follows:

a1) Fit new O-ring seals to the groove in the pipe ends.

a2) Screw the outer sleeve to the pipe, hand-tight, and wire-lock it to the flange on the pipe end fitting.

a3) Insert the inner sleeve into the outer sleeve. Ensure, by observation through the inspection holes, that the inner sleeve is fully inserted, covering the pipe end and O-ring seal.

a4) Ensure that the two half piston rings, circlip and O-ring seal on the bulkhead pipe are securely in position.

a5) Holding the inner sleeve in position through the inspection holes, slide the pipe and its outer sleeve fully forward into position over the piston ring. Ensure that the O-ring seals are not damaged or dislodged.

(b) At frame 82, secure the pivot block to the mounting bracket with the special bolt, washer and nut. Fit a washer and shim washers as necessary to the bolt between the inside lugs of the bracket and the pivot block. Torque-tighten the nut to between 80 and 90 lbf in (0.904 and 1.017 mdaN) and lock it with a split pin.

(3) Install the short pipe (RH) at frames 82-83 as follows:

(a) Insert the pipe into the adjoining pipe sleeve aft of frame 82.

(b) Loosely fit the clip assembly (Detail A). Do not tighten the clip assembly nuts or connect the coupling at this stage.

NOTE: The installation is completed after operation (4).

(4) Install the stainless steel pipe (RH) at frames 83-84 as follows:

(a) Fit a new O-ring seal to the groove in the pressure holding non-return valve outlet (Ref. 28-23-55, Removal/Installation).

(b) Position the pipe and secure the pipe fitting at frame 84 to the mounting bracket with the two bolts, washers, shim washers and nuts. Fit the shim washers in the position noted during removal, as required to align the pipe. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

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(c) At frame 83, position the half clamp over the pipe and secure it loosely with the four bolts, washers and nuts.

(d) Check that the gate link and pipe clamp assembly meet the installation requirements (Ref. para.1.).

(e) Torque-tighten each nut of the clamp assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(f) Secure the pressure holding non-return valve outlet (Ref. 28-23-55, Removal/Installation) to the pipe with the four bolts, washers, clips and nuts, ensuring that the bonding lead is correctly positioned. Check that the angle between the axes of the non-return valve and the trim pipe does not exceed 2 deg. Torque-tighten the bolts to between 74 and 80 lbf in (0.836 and 0.904 mdaN). Wire-lock the bolt heads in pairs and the clips in pairs.

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(5) Complete the installation of the short pipe (RH) at frames 82-83 as follows:

(a) Check that the gapping tolerances at each pipe end are in accordance with Table 402.

(b) Torque-tighten each nut of the clip assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(c) Fit and tighten each Gamah nut at the pipe ends.

(6) Install the short pipe (RH) at frames 84-85 as follows:

(a) At frame 84, position the pipe sleeve over the adjoining pipe end.

(b) Loosely fit the clip assembly (Detail A). Do not tighten the clip assembly nuts or connect the coupling at this stage.

<u>NOTE</u>: The installation is completed after operation (7).

(7) Install the pipe (RH) at frames 85-86 as follows:

(a) Position the pipe and secure the pipe fitting at frame 85 to the mounting bracket with the two bolts, washers, shim washers and nuts. Fit the shim washers in the positions noted during removal, to achieve a shim fit of the mounting bracket. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(b) At frame 86, position the half clip over the pipe and secure it loosely with the two nuts and washers.

(c) Check that the gate link and pipe clip meet the installation requirements (Ref. para.1.).

(d) Torque-tighten each nut securing the clip to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(8) Complete the installation of the short pipe (RH) at frames 84-85 as follows:

(a) Check that the gapping tolerances at each pipe end are in accordance with Table 402.

(b) Torque-tighten each nut of the clip assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(c) Fit and tighten each Gamah nut at the pipe ends.

(9) Install the Y-pipe (RH) at frames 86-88 as follows:

(a) Position the pipe with the forward end at frame 86 inserted into the sleeve of the adjoining pipe. Do not connect the coupling at this stage.

(b) At frame 87, secure the pipe fitting to the tie rod with the bolt, washer and nut. Torque-tighten the nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

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(c) If the tie rod is adjusted to achieve pipe alignment, check that rod-end thread is visible through the tie-rod turnbuckle inspection holes. Torque-tighten the 1/2 in (12.7 mm) dia. rod-end locknut to between 140 and 160 lbf in (1.582 and 1.808 mdaN) and the 5/16 in (7.9 mm) dia. rod-end locknut to between 100 and 120 lbf in (1.130 and 1.356 mdaN) and wire-lock them.

(d) Check that the gapping tolerance at the forward pipe end is in accordance with Table 402.

(e) Fit and tighten the Gamah nut at frame 86.

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(10) Install the inlet elbow (RH) (Detail C), upstream of the inlet valve, as follows:

(a) Fit new O-ring seals to the spool and fit the spool to the elbow.

(b) Fit a new O-ring seal to the groove in the elbow flanged pipe end.

(c) Assemble the link rods and fit them to the elbow fitting with the bolts, nuts and washers. Do not tighten the nuts at this stage.

(d) Secure the elbow to the inlet valve canister with the four bolts and washers. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock it.

(e) Check that the end float of the elbow spool (i.e., total axial travel) is between 0.2 and 0.5 in (5.1 and 12.7 mm) in relation to its adjoining pipes.

(f) Adjust the link rods if necessary, checking that the distance between the bolt hole centres is between 4.1 and 4.6 in (104 and 117 mm). Torque-tighten each rod-end locknut to between 100 and 120 lbf in (1.130 and 1.356 mdaN) and wire-lock it.

(g) Secure the link rods to the pipe fittings with the four bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(11) Install the jettison elbow (RH) (Detail E) as follows:

(a) Fit a new O-ring seal to the elbow flanged pipe end.

(b) Secure the elbow to the bulkhead mounting with the four bolts, washers and nuts. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(c) Check that the gapping tolerance at the forward pipe end is in accordance with Table 402.

(d) Fit and tighten the Gamah nut at the coupling.

(12) Install the jettison pipe (RH) (Detail D) as follows:

(a) Fit new O-ring seals to the spool and fit the spool to the pipe.

(b) Position the pipe, inserting the spool into the bulkhead mounted pipe and the sleeve over the jettison elbow flanged pipe end.

(c) Check that the adjustable bracket at the pipe trunnion meets the installation requirements for swinging (Ref. para.1.).

(d) Secure the pipe trunnion to the adjustable bracket with the two bolts and tabwashers. Torque-tighten each bolt to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with the tabwasher in accordance with 20-21-17. Wire-lock the tabwasher to the pipe trunnion.

(e) Secure the pipe fitting to the mounting pillar on the rear bulkhead with the two bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(f) Secure the pipe flanged sleeve to the jettison elbow with the six bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(g) Check that the gaps at the pipe spool are a nominal 0.2 in (5.1 mm) at the forward end and 0.2(±0.05) in (5.1(±1.3) mm) at the rearward end.

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(h) Assemble the link rods and fit them to the jettison pipe fitting with the bolts, washers and nuts. Do not tighten the nuts at this stage.

(j) Adjust the link rods if necessary, checking that the distance between the bolt hole centres is between 2.65 and 2.85 in (66.2 and 77.1 mm). Torque-tighten each rod locknut to between 100 and 120 lbf in (1.130 and 1.350 mdaN) and wire-lock it.

(k) Secure the link rods to the pipe fittings with the four bolts, washers and nuts. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

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(13) Install the inlet elbow (RH), downstream of the inlet valve, as follows:

(a) Fit a new O-ring seal to the groove in the inlet elbow flanged pipe end.

(b) Secure the inlet elbow to the inlet valve canister with the four bolts and washers. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock it.

(14) Install the diffuser and short pipe (RH) as follows:

(a) Insert the short pipe into the diffuser sleeve. Assemble the clip assembly to the pipes with the bolts, washers and nuts. Do not tighten the nuts at this stage.

(b) Position the pipes, inserting the upper end of the short pipe into the inlet elbow sleeve. Secure the clip assembly to the bulkhead mounting with the two bolts, washers and nuts. Torque-tighten each nut to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(c) Check that the gaps at each Gamah coupling are in accordance with Table 402.

(d) Torque-tighten each nut of the clip assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(e) Fit and secure the nuts at each Gamah coupling.

(f) At the lower end of the diffuser, check that the swinging link and pipe clip meet the installation requirements (Ref. para.1.).

(g) Fit the pipe half-clip and secure it with the two nuts and washers. Torque-tighten each nut to between 12 and 15 lbf in (0.146 and 0.169 mdaN) and lock it with a split pin.

G. Install LH System Pipes (Tank 11)

NOTE: These procedures assume that all pipes are removed.

Gamah couplings are to be installed in accordance with 20-23-21.

Split pins are to be fitted in accordance with 20-21-12.

All O-ring seals are to be lubricated in accordance with 20-23-11.

Wire-locking is to be in accordance with 20-21-13.

(1) Observe the fuel and electrical safety precautions.

(2) Install the pipe (LH) at frames 81-82 as follows:

(a) Loosely fit the clip assembly (Detail A) to the rearward end of the pipe.

(b) Insert the forward end of the pipe into the pipe sleeve at the bulkhead. Do not fit the Gamah nut at this stage.

NOTE: The installation of the pipe is completed after operation (3).

(3) Install the stainless steel pipe (LH) at frames 82-83 as follows:

(a) Fit a new O-ring seal to the groove in the pressure holding non-return valve outlet (Ref. 28-23-55, Removal/Installation).

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(b) Position the pipe and secure the pipe fitting at frame 83 to the mounting bracket with the two bolts, washers, shim washers and nuts. Fit the shim washers in the positions noted during removal to achieve a shim fit of the mounting bracket. Torque-tighten each nut to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and lock it with a split pin.

(c) At frame 82, position the half clamp over the pipe and secure it loosely with the four bolts, washers and nuts.

(d) Check that the gate link and pipe clamp assembly meet the installation requirements (Ref. para.1.).

(e) Torque-tighten each nut of the pipe clamp assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(f) Secure the pressure holding non-return valve outlet (Ref. 28-23-55, Removal/Installation) to the pipe with the four bolts, washers, clips and nuts, ensuring that the bonding lead is correctly positioned. Check that the angle between the axes of the non-return valve and the trim pipe does not exceed 2 deg. Torque-tighten the bolts to between 74 and 80 lbf in (0.836 and 0.904 mdaN). Wire-lock the bolt heads in pairs and the clips in pairs.

(4) Complete the installation of the short pipe (LH) at frames 81-82 as follows:

(a) Check that the gapping tolerances at each pipe end are in accordance with Table 402.

(b) Torque-tighten each nut of the clip assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(c) Fit and tighten each Gamah nut at the pipe ends.

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(5) Install the pipe (LH) at frames 83-85 as follows:

NOTE: This pipe is not bolted to the frames and it must therefore be supported in position during the installation of the adjoining rearward pipe at frames 85-86 (Ref. para.(6)).

(a) Position the pipe sleeve at the forward end over the adjoining pipe flange.

NOTE: The installation is completed after operation (6).

(6) Install the pipe (LH) at frames 85-86 as detailed for the similar, but opposite-handed pipe (RH) at frames 85-86 (Ref. para.F.(7)).

(7) Complete the installation of the pipe (LH) at frames 83-85 as follows:

(a) Fit the clip assembly (Detail A) to the coupling at frame 85. Do not tighten the nuts at this stage.

(b) Check that the gap at each pipe end is in accordance with Table 402.

(c) Torque-tighten each nut of the clip assembly to between 12 and 15 lbf in (0.136 and 0.169 mdaN) and lock it with a split pin.

(d) Fit and tighten the Gamah nuts at the pipe ends.

(8) Install pipes (LH) aft of frame 86 as detailed for the similar, but opposite-hand pipes in the RH system (Ref. para.F.(9) to (14)).

H. Conclusion

(1) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig.402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts. Torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(2) Check that all disturbed pipes are bonded in accordance with 20-27-11.

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(3) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(4) Carry out a Leakage Test of the disturbed piping (Ref. 28-23-00, Adjustment/Test).

R (5) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

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R (6) Ensure that the mating faces of the tank access panel and structure are clean.

R (7) Fit a new door seal, lubricated with petroleum jelly.

R (8) Refit the panel as follows:

(a) Simultaneously, insert the door bolts from the LH and RH sides of the door and progressively work toward the centre. Hand-tighten the bolts in the same procedure.

(b) Alternatively, working from the LH and RH sides of the door and progressively toward the centre, torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(c) Repeat the above operation (b), but torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

R (9) Check that the electrical resistance between the panel and adjacent structure is in accordance with 20-27-11.

R (10) After refuelling, check the tank access panel for freedom from leakage.

TRIM TRANSFER SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE AIRCRAFT GROUND STABILITY SAFETY PRECAUTIONS DETAILED IN 12-00-10.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

R FUEL TRIM TRANSFER INLET VALVES SHOULD REMAIN SHUT AT ALL
R TIMES, EXCEPT WHEN BEING OPERATED FOR A SPECIFIC MAINTENANCE
R TASK. ENSURE VALVES ARE SHUT BEFORE VACATING FLIGHT DECK.
R NOSE GEAR SHOCK ABSORBER EXTENSION IS A GOOD INDICATION OF
R AIRCRAFT OVERBALANCE AND SHOULD NEVER EXCEED 23.5 IN (596 MM).

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1. General

The trim transfer system is used to redistribute the trim tank fuel to shift the aircraft centre of gravity to predetermined positions, for subsonic and supersonic flight and take-off. It is also used during pressure refuelling and defuelling and in jettisoning fuel.

The control switches and indication equipment for the trim transfer pumps and the associated tank inlet valves are disposed in a fuel-flow pattern on the fuel system management panel at the third crew member's station. A trim transfer override switch is also mounted in the pilot's roof panel.

Operational, Functional and leakage tests are detailed in the following procedures. A System Test is not applicable.

The Operational Tests individually check the system components through controls mounted on the fuel management panel. The Functional Tests include flow-testing of the system, and a test of the automatic trim transfer control.

The tests (Ref. paras.3., 4., 5., 6., 7., 8., 9., 10., 11. and 12.) in total comprise a comprehensive check of the trim transfer system components. Headings and details of the tests in this topic are as follows:

Operational Test - Standby Inlet Valves (Ref. para.2.).

This test checks the operation of tanks 1, 2, 3, 4 and 10 valves by reference to their associated magnetic indicators. As the valves for tanks 5, 6, 7 and 8 do not have magnetic indicators on the fuel management panel, a small amount of fuel is transferred through these valves to confirm their open and shut positions.

Operational Test - Trim Valve Standby Motors (Ref. para.3.)

This test checks the operation and control of the trim valves via the A and B essential 28 V d.c. supplies, override control switches and standby motors. The main motor electrical supplies are isolated for this test.

Operational Test - Manual Control of Forward and Rearward Trim Transfer (Ref. para.4.)

This test checks the operation of the trim pumps in tanks 9, 10 and 11 and the operation of the trim valves in tanks 5, 7, 9 and 11 via their main switches. It also verifies fuel flow into the selected tanks. Fuel flow rates are not checked in this test.

Operational Test - Tank 11 LH Pump, De-air Mode Inhibit (Ref. para.5.)

This test checks that when the pump has been switched on by its de-air switch, the pump is switched off and isolated from the de-air switch when rearward transfer is selected.

Before SB 28-048

Operational Test - Auto-reset of T/O CG Switch (Ref. para.6.)

This test checks the interaction of tanks 9 and 10 trim pump contactors with the latching solenoid of the T/O CG switch.

After SB 28-048 For A/C 001-005,

Operational Test - Auto-reset of T/O CG Switch (including Trim Pump Start Control Unit) (Ref. para.6.)

This test uses a switching sequence for a pair of pump switches (tank 9 LH and RH, and 10 LH and RH) so that the delayed energizing of the trim pump contactors, by the control units, can be confirmed by the resetting of the T/O CG switch from 54% to NORM.

Operational Test - Automatic Forward Trim Override (Ref. para.7.)

This test checks that, when the trim transfer system is set to transfer fuel rearward, operation of the FUEL FWD TRANS switch to O/RIDE cancels the rearward transfer and starts a forward transfer, using all four tank 11 pumps.

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After SB 28-048 For A/C 001-005,

Functional Test - Fuel Pump Start Control Unit (Ref. para.8.)

This test checks that the control units are operating satisfactorily, by using their built-in test equipment (BITE), and also confirms the latching function of the associated trim pump contactors.

Functional Test - Automatic Trim Transfer (Ref. para.9.)

This test checks that the trim transfer system operates satisfactorily under control of the auto master switch and fuel quantity load limit control selectors.

Functional Test - Load Limit Control, Zero Locking Inhibition (Ref. para.10.)

This test checks the correct operation of the Standby CG packs zero locking inhibition for tank 11 load limit control.

Functional Test - Trim Valves, High Level Shut-off (Ref. para.11.)

This test checks the automatic closing of the trim valves in tanks 5, 7, 9 and 11 when the associated tank fuel contents reaches the high level sensors.

Flow Test - Trim Transfer System (Ref. para.12.)

This test checks trim transfer fuel flow rates into tanks 9, 5, 7 and 11.

Trim Pipes Leakage Test - Zone 153/4 (Ref. para.13.)

Trim pumps are used to pressurize the trim piping in Zone 153/4, so that an inspection for fuel leaks can be carried out.

Pipeline Leakage Test (Ref. para.14.)

This test uses ground equipment to pressurize the trim pipes to a higher pressure than that given by the trim pumps. This test is required after replacement of any part of the trim system piping.

R Alternative Pipeline Leakage Check Using Front Trim Pumps
R (Ref. para.15)

R The front trim pumps are used to check trim transfer pipes and
R couplings for leakage over a 15 min period.

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2. Operational Test - Standby Inlet Valves (Ref. Fig.501)

A. Prepare to Test Standby Inlet Valves

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that each of tanks 2 and 3 contains not less than 1,000 kg of fuel and that there is room in tanks 5, 6, 7 and 8 to receive, by transfer, a small amount of fuel. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing) as required.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(4) Attach a placard to the refuel control panel door to warn that work is being carried out on the fuel system.

B. Test Standby Inlet Valves

(1) Set tanks 1, 2, 3, 4 and 10 STANDBY INLET VALVES switches to "OPEN". Check that the associated magnetic indicator display changes from SHUT to diagonal stripes and then to OPEN within 2 s.

(2) Set tanks 1, 2, 3, 4 and 10 STANDBY INLET VALVES switches to "SHUT". Check that the associated magnetic indicator display changes from OPEN to diagonal stripes and then to SHUT within 2 s.

NOTE: As tanks 5, 6, 7 and 8 standby inlet valves do not have associated magnetic indicators, it is necessary to transfer a small amount of fuel into the respective tanks to prove the operation of these valves.

(3) Set tanks 2 and 3 collector jettison valve switches to "OPEN". Check that the associated magnetic indicators display changes from bar-across-line to diagonal stripes and then to bar-in-line.

(4) Set the switches for the 2nd standby ENGINE FEED PUMPS

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in tanks 2 and 3, to "ON". Check that the associated LOW PRESS captions are extinguished.

(5) Check for a period of not less than 1 min that fuel is not transferring out of tanks 2 and 3.

(6) Set tanks 5 and 6 STANDBY INLET VALVES switches to "OPEN". Check, by reference to the fuel quantity indicators, that fuel is transferring from tank 2 into tanks 5 and 6.

(7) Set tanks 5 and 6 STANDBY INLET VALVES switches to "SHUT". Check, by reference to the fuel quantity indicators, that fuel transfer stops.

(8) Set tanks 7 and 8 STANDBY INLET VALVES switches to "OPEN". Check, by reference to the fuel quantity indicators, that fuel is transferring from tank 3 into tanks 7 and 8,

(9) Set tanks 7 and 8 STANDBY INLET VALVES switches to "SHUT". Check, by reference to the fuel quantity indicators, that fuel transfer stops.

C. Conclusion

(1) Set tanks 2 and 3 2nd standby ENGINE FEED PUMPS switches to "OFF".

(2) Set tanks 2 and 3 collector jettison valve switches to "SHUT". Check that the associated magnetic indicator display changes from bar-in-line to diagonal stripes and then to bar-across-line.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

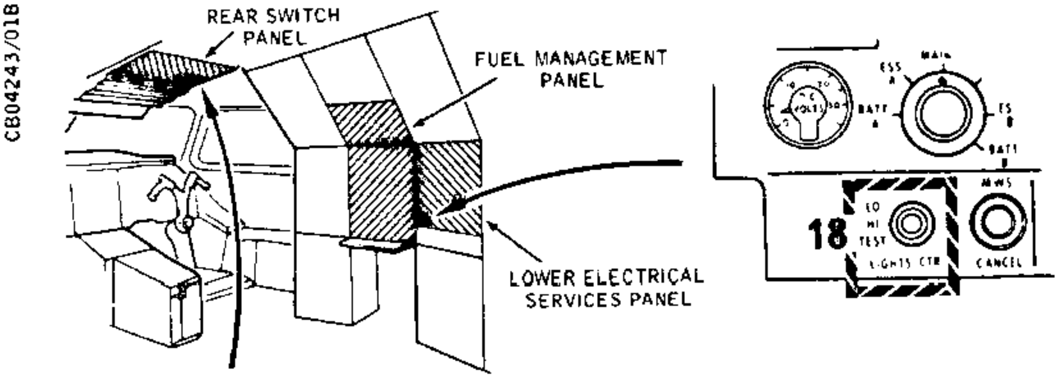
(4) Remove the warning placard from the refuel control panel door.

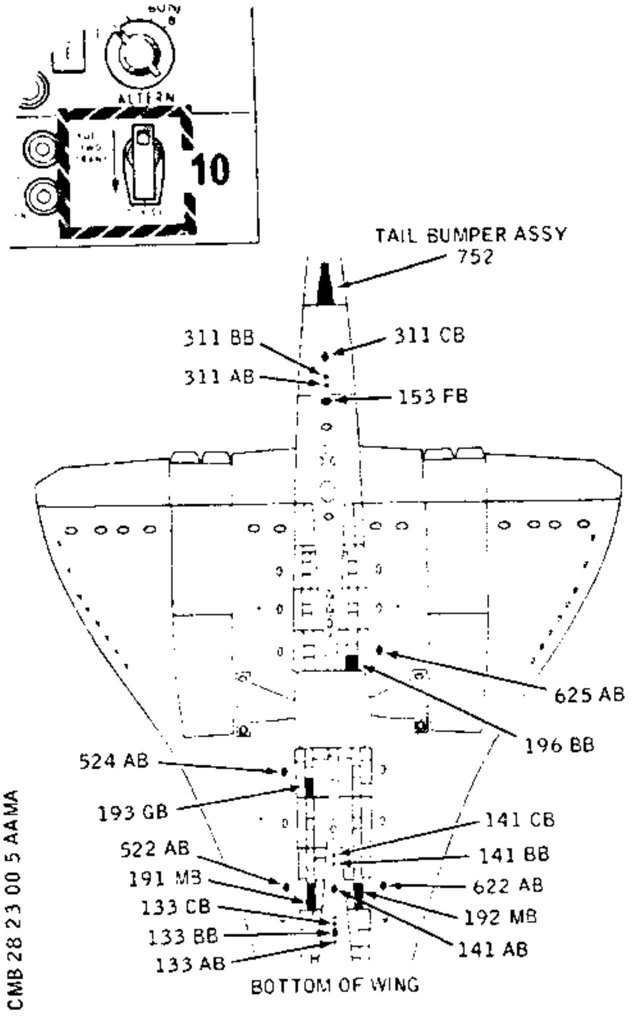
(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. <u>Operational Test - Trim Valve Standby Motors</u> (Ref. Fig. 501)

A. Prepare to Test Trim Valve Standby Motors

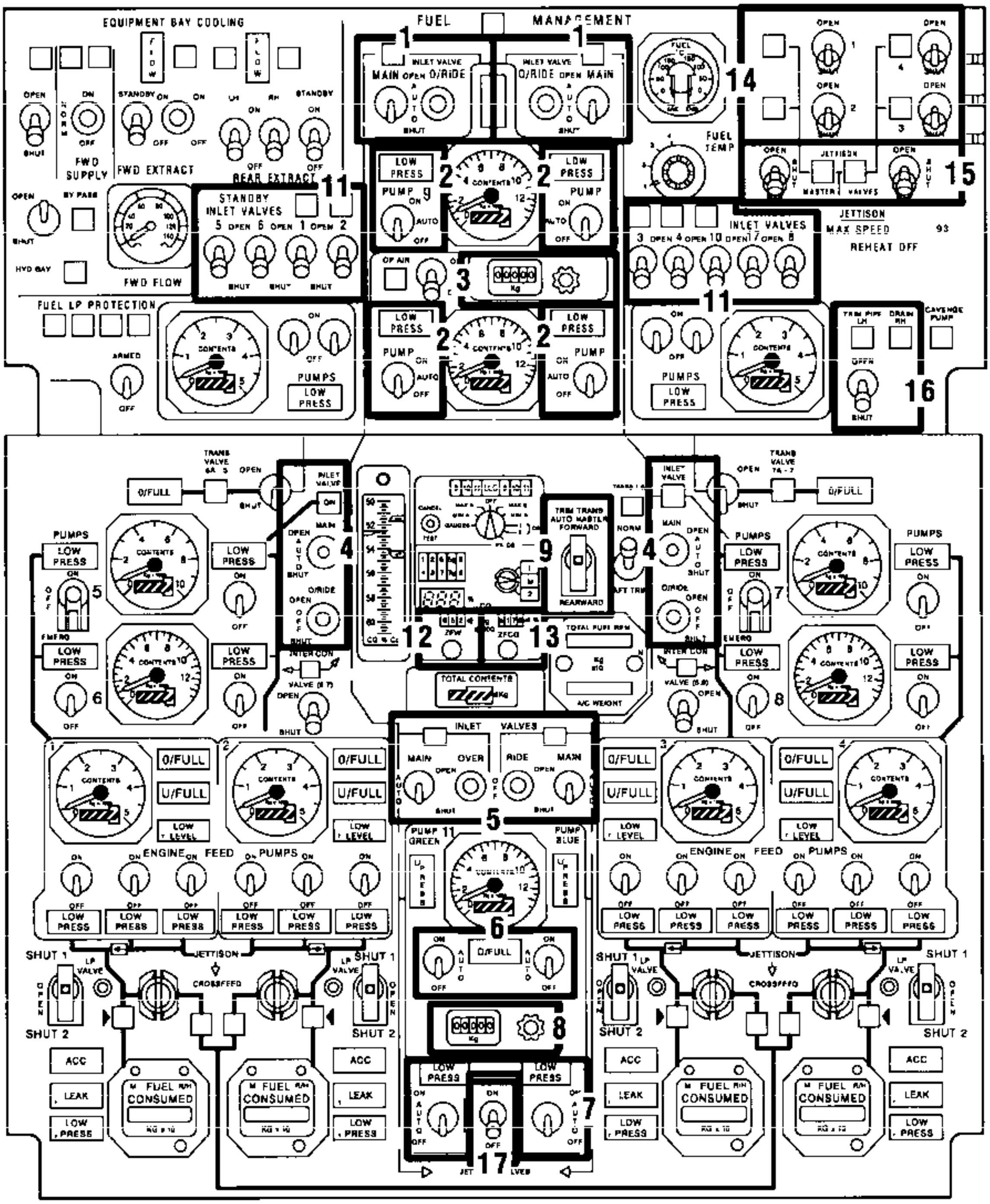
(1) Make available electrical ground power as detailed in 24-41-00.





1 TANKS 9 AND 10 INLET VALVE CONTROL SWITCHES AND INDICATOR
2 TANKS 9 AND 10 PUMPS (ELECTRIC) CONTROL SWITCH AND CAPTION LIGHT
3 TANKS 9 AND 10 LOAD LIMIT SELECTOR
4 TANKS 5 AND 7 INLET VALVE CONTROL SWITCHES AND INDICATOR
5 TANK 11 INLET VALVES CONTROL SWITCHES AND INDICATORS
6 TANK 11 PUMPS (HYDRAULIC) CONTROL SWITCHES AND CAPTION LIGHT
7 TANK 11 PUMPS (ELECTRIC) CONTROL SWITCHES AND CAPTION LIGHTS
8 TANK 11 LOAD LIMIT SELECTOR
9 TRIM TRANSFER AUTO MASTER SWITCH
10 FUEL FORWARD TRANSFER OVERRIDE SWITCH
11 STANDBY INLET VALVES SWITCHES AND INDICATORS
12 ZERO FUEL WEIGHT SELECTOR
13 ZERO FUEL CG SELECTOR
14 COLLECTOR TANK JETTISON VALVE SWITCH AND INDICATOR
15 JETTISON MASTER VALVES SWITCHES AND INDICATORS
16 TRIM PIPE DRAIN VALVES SWITCH AND INDICATORS
17 TANK 11 PUMP (ELECTRIC) DE-AIR SWITCH
18 CAPTION LIGHT TEST SWITCH

- Trim Transfer Controls and Indicators (Sheet 1)
Figure 501



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Fuel Management Panel
Trim Transfer Controls and Indicators (Sheet 2)
Figure 501

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(3) Attach a placard to the refuel control panel door to warn that work is being carried out on the fuel system.

B. Test Trim Valve Standby Motors

(1) Trip the following circuit breakers.

NOTE: When the O/RIDE switch is in the OFF position, an electrical supply for the main motor closed contacts is available by way of the O/RIDE switch and valve control relay. To ensure that electrical power is available only for the standby motors, the main motor supply circuit breaker must be tripped.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5 INLET VALVE MAIN SUP	15-215	Q363	G20
TANK 7 INLET VALVE MAIN SUP	15-216	Q364	D5
TANK 9 LH INLET VALVE MAIN SUP	15-215	Q361	G19
TANK 9 RH INLET VALVE MAIN SUP	15-216	Q362	D4
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q365	G21
TANK 11 RH INLET VALVE MAIN SUP	15-216	Q366	D6

(2) Set tanks 5, 7, 10LH, 10RH, 11LH and 11RH INLET VALVES O/RIDE switches to "OPEN". Check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes and then to bar-in-line within 2 s of switch operation.

(3) Set the INLET VALVES O/RIDE switch to "OFF". Check that the associated magnetic indicator display remains at bar-in-line.

(4) Set the INLET VALVES O/RIDE switch to "SHUT". Check that the associated magnetic indicator display changes from bar-in-line to diagonal stripes and then to bar-across-line within 2 s of switch operation.

(5) Set the INLET VALVES O/RIDE switch to "OFF".

C. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Remove the warning placard from the refuel control panel door.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Operational Test - Manual Control of Forward and Rearward Trim Transfer

A. Prepare to Test Manual Control of Trim Transfer

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required:-

(a) Tank 9 - 4,000 kg

(b) Tank 10 - Full

(c) Tanks 1 and 4 - Full

(d) Tank 11 - 1,000 kg

(e) Remaining tanks - empty, i.e., at unusable level.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access

door is closed.

(4) Attach a placard to the refuel control panel door to warn that tests are being carried out on the fuel system.

(5) So that tank 11 GREEN and BLUE pumps can be operated, pressurize the hydraulic systems, using the ground pressurizing system (Ref. 29-23-00).

B. Test Manual Control of Trim Transfer

CAUTION: TO REDUCE PRESSURE SURGES IN THE MAIN TRIM TRANSFER PIPES, THE TRIM PUMPS IN TANKS 9 AND 10 MUST NOT BE SWITCHED ON BEFORE AN ASSOCIATED LH AND/OR RH TRIM INLET VALVE IS OPENED.

After SB 28-048 For A/C 001-005,

CAUTION: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

NOTE: During this test, it must be ensured that other hydraulic systems/services are not operated.

(1) Using the manual control sequence chart, Table 501, operate the valves and pumps as detailed, and observe the following points:-

(a) Check correct operation of the valves by reference to their associated magnetic indicators.

(b) Check that the associated pumps LOW PRESS captions are illuminated and then extinguished when the pumps are switched on.

(c) Confirm fuel transfer by reference to the fuel quantity indicators.

(d) As soon as fuel transfer is verified, shut the associated inlet valve.

OPERATION NO.	INITIAL SETTING INLET VALVE	INITIAL SETTING PUMP SWITCH	FUEL TRANSFERS TO:	FINAL SETTING INLET VALVE	FINAL SETTING PUMP SWITCH
(1)	Tank 11 LH MAIN "OPEN"	Tank 9 LH "ON"	Tank 11	Tank 11 LH MAIN "SHUT"	Tank 9 LH "OFF"
(2)	Tank 5 MAIN "OPEN"	Tank 10 LH "ON"	Tank 5	Tank 5 MAIN "SHUT"	Tank 10 LH "ON"
(3)	Tank 11 LH MAIN "OPEN"	Tank 10 LH "ON"	Tank 11	Tank 11 LH MAIN "SHUT"	Tank 10 LH "OFF"
(4)	Tank 11 RH MAIN "OPEN"	Tank 9 RH "ON"	Tank 11	Tank 11 RH MAIN "SHUT"	Tank 9 RH "OFF"
(5)	Tank 7 MAIN "OPEN"	Tank 10 RH "ON"	Tank 7	Tank 7 MAIN "SHUT"	Tank 10 RH "ON"
(6)	Tank 11 RH MAIN "OPEN"	Tank 10 RH "ON"	Tank 11	Tank 11 RH MAIN "SHUT"	Tank 10 RH "OFF"
(7)	Tank 9 LH MAIN "OPEN"	Tank 11 LH "ON"	Tank 9	Tank 9 LH MAIN "SHUT"	Tank 11 LH "OFF"
(8)	Tank 5 MAIN "OPEN"	Tank 11 GREEN "ON"	Tank 5	Tank 5 MAIN "SHUT"	Tank 11 GREEN "OFF"
(9)	Tank 9 RH MAIN "OPEN"	Tank 11 RH "ON"	Tank 9	Tank 9 RH MAIN "SHUT"	Tank 11 RH "OFF"
(10)	Tank 7 MAIN "OPEN"	Tank 11 BLUE "ON"	Tank 7	Tank 7 MAIN "SHUT"	Tank 11 BLUE "OFF"

Trim Transfer Manual Control Sequence Chart
Table 501

C. Conclusion

(1) Switch off the ground pressurizing system (Ref. 29-23-00).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Remove the warning placard from the refuel control panel door.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. Operational Test - Tank 11 LH Pump, De-air Mode Inhibit

A. Prepare to Test Tank 11 LH Pump, De-air Mode Inhibit

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required:-

(a) Tank 9 - 4,000 kg

(b) Tank 10 - Full

(c) Tanks 1 + 4 - Full

(d) Tank 11 - 1,000 kg

(e) Remaining tanks - empty, i.e., at unusable level

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

B. Test Tank 11 LH Pump, De-air Mode Inhibit

(1) Set tanks 9 and 10 load limit control (LLC) selector to 200 kg less than the combined fuel quantities of tanks 9 and 10.

(2) Set tank 11 LLC selector to 200 kg more than the fuel quantity in tank 11.

(3) Set tank 11 DE-AIR switch to "ON". Check that the LH LOW PRESS caption is illuminated and then extinguished.

(4) Set the TRIM TRANS AUTO MASTER switch to "REARWARD" and check that tank 11 LH pump stops running and its LOW PRESS caption is illuminated. After 10 s set the switch to "OFF".

NOTE: The time limit in itself is not significant. The purpose is to limit the amount of fuel being transferred rearward and also to give sufficient time for the inlet valves to open fully.

For this test, operation of pumps and valves other than tank 11 LH pump may be disregarded.

(5) Set the tank 11 DE-AIR switch to "OFF"; check that the LOW PRESS caption is extinguished.

C. Conclusion

(1) Set tanks 9 and 10 and tank 11 LLC selectors to "00000".

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

Before SB 28-048 For A/C 003-012

6. Operational Test - Auto-reset of T/O CG Switch

NOTE: This test checks the interaction of tanks 9 and 10 trim pump contactors with the latching solenoid of the T/O CG switch.

A boundary warning test associated with the T/O CG switch is included in 28-44-00, Adjustment/Test.

A. Prepare to Test Auto-reset of T/O CG Switch

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that tanks 9 and 10 contain fuel and that tank 9 fuel quantity is not more than 10,000 kg.

Refuel (Ref. 12-11-28), defuel (Ref. 28-25-00) or transfer fuel (Ref. 28-00-00, Servicing) as required.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

B. Test Auto-reset of T/O CG Switch

CAUTION: TO REDUCE PRESSURE SURGES IN THE MAIN TRIM TRANSFER PIPES, OPEN AN ASSOCIATED TRIM INLET VALVE BEFORE SWITCHING ON THE TRIM TRANSFER PUMP.

(1) Using the auto-reset sequence chart, Table 502, operate the pumps and switches as detailed. Check that the T/O CG switch resets to NORM when any pair of pumps (LH and RH) is switched ON.

OPERATION NO.	TRIM INLET VALVE SETTING	T/O CG SWITCH SETTING	TRIM PUMP SETTING	T/O CG SWITCH	TRIM PUMP SETTING
(1)	Tank 9 LH MAIN "OPEN"	"54 %"	Tank 9 LH "ON"	54 %	Tank 9 LH "OFF"
(2)	Tank 9 RH MAIN "OPEN"	"54 %"	Tank 9 RH "ON"	54 %	Tank 9 RH "OFF"
(3)	Both valves left OPEN	"54 %"	Tank 10 LH "ON"	54 %	Tank 10 LH "OFF"
(4)	Both valves left OPEN	"54 %"	Tank 10 RH "ON"	54 %	Tank 10 RH "OFF"
(5)	Both valves left OPEN	"54 %"	Tank 9 LH and RH "ON"	NORM	Tank 9 LH and RH "OFF"
(6)	Both valves left OPEN	"54 %"	Tank 9 LH and 10 RH "ON"	NORM	Tank 9 LH and 10 RH "OFF"

OPERATION NO.	TRIM INLET VALVE SETTING	T/O CG SWITCH SETTING	TRIM PUMP SETTING	T/O CG SWITCH	TRIM PUMP SETTING
(7)	Both valves left OPEN	"54 %"	Tank 9 RH and 10 LH "ON"	NORM	Tank 9 RH and 10 LH "OFF"
(8)	Tank 9 LH MAIN and RH MAIN "SHUT"	-	-	-	-

Auto-reset Sequence Chart
Table 502

C. Conclusion

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

After SB 28-048 For A/C 001-005,

6. Operational Test - Auto-reset of T/O CG Switch (including Trim Pumps Start Control Unit)

NOTE: This test uses a switching sequence for a pair of pump switches (tank 9 LH and RH, and 10 LH and RH) so that the delayed energizing of the associated trim pump contactors, by their associated pump start control units, can be confirmed by the resetting of the T/O CG switch from 54 % to NORM.

A boundary warning test associated with the T/O CG switch is included in 28-44-00, Adjustment/Test.

A. Prepare to Test Auto-reset of T/O CG Switch

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that tanks 9 and 10 contain fuel and that tank 9 fuel quantity is not more than 10,000 kg. Refuel (Ref. 12-11-28), defuel (Ref. 28-25-00) or transfer fuel (Ref. 28-00-00, Servicing) as required.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

B. Test Auto-reset of T/O CG Switch

CAUTION: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

(1) Using the auto-reset sequence chart, Table 502, operate the pumps and switches as detailed. Check that the T/O CG switch resets to NORM after 5 s when any pair of pumps (LH and RH) is switched ON.

OPERATION NO.	T/O CG SWITCH SETTING	TRIM PUMP SETTING	T/O CG SWITCH	TRIM PUMP SETTING
(1)	"54 %"	Tank 9 LH "ON" for 10 s	54 %	Tank 9 LH "OFF"
(2)	"54 %"	Tank 9 RH "ON" for 10 s	54 %	Tank 9 RH "OFF"
(3)	"54 %"	Tank 10 LH "ON" for 10 s	54 %	Tank 10 LH "OFF"
(4)	"54 %"	Tank 10 RH "ON" for 10 s	54 %	Tank 10 RH "OFF"
(5)	"54 %"	Tank 9 LH "ON" for not less than 6 s, then 9 RH "ON" for 10 s	5 s after 9 RH ON, "NORM"	Tank 9 LH left ON, 9 RH "OFF"
(6)	"54 %"	With 9 LH left on, tank 10 RH "ON" for 10 s	5 s after 10 RH ON, "NORM"	Tank 9 LH and 10 RH "OFF"
(7)	"54 %"	Tank 9 RH "ON" for not less than 6 s, then 10 LH "ON" for 10 s	5 s after 10 LH ON, "NORM"	Tank 9 RH and 10 LH "OFF"

OPERATION NO.	T/O CG SWITCH SETTING	TRIM PUMP SETTING	T/O CG SWITCH	TRIM PUMP SETTING

Auto-reset Sequence Chart
Table 502

C. Conclusion

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

7. Operational Test - Automatic Forward Trim Override

A. Prepare to Test Automatic Forward Trim Override

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required:-

(a) Tank 9 - 4,000 kg

(b) Tank 10 - Full

(c) Tanks 1 and 4 - Full

(d) Tank 11 - 1,000 kg

(e) Remaining tanks - empty, i.e., at unusable level.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(4) So that tank 11 GREEN and BLUE pumps can be operated, pressurize the hydraulic systems, using the ground pressurizing system (Ref. 29-23-00).

B. Test Automatic Forward Trim Override

NOTE: During this test, it must be ensured that other hydraulic systems/services are not operated.

(1) Set tanks 9 and 10 load limit control (LLC) selector to 13,060 kg.

(2) Set tank 11 (LLC) selector to 2,000 kg.

(3) Set the TRIM TRANS AUTO MASTER switch to "REARWARD". Check that -

(a) tank 11 LH and RH trim inlet valves open,

(b) tank 9 LH and RH pumps LOW PRESS captions are illuminated and then extinguished,

(c) tank 10 LH and RH pumps LOW PRESS captions are illuminated, and

(d) fuel is seen to be transferring into tank 11.

(4) At panel 4-211, set the FUEL FWD TRANS switch to "O/RIDE". Check that -

(a) tank 11 LH and RH trim inlet valves close,

(b) tank 9 LH and RH trim inlet valves open,

(c) tank 9 LH and RH pumps are heard to stop running but their associated LOW PRESS captions are not illuminated,

(d) tank 10 LH and RH LOW PRESS captions are extinguished,

(e) all four tank 11 pumps LOW PRESS captions are illuminated and then extinguished, and

(f) fuel is seen to be transferring into tank 9.

(5) Set the FUEL FWD TRANS switch to the 'locked' position. Check that -

(a) tank 11 LH and RH trim inlet valves open,

(b) tank 9 LH and RH trim inlet valves close,

(c) tank 11 pumps stop running but their associated LOW PRESS captions are not illuminated,

(d) tank 9 LH and RH pumps start running,

(e) tank 10 LOW PRESS captions are illuminated, and

(f) fuel is seen to be transferring into tank 11.

(6) Set the TRIM TRANS AUTO MASTER switch to "OFF". Check that -

(a) tank 11 LH and RH trim inlet valves close,

(b) tank 9 LH and RH pumps stop running,

(c) tank 10 LOW PRESS captions are extinguished, and

(d) fuel transfer stops.

C. Conclusion

(1) Switch off the ground pressurizing system (Ref. 29-23-00).

(2) Set tanks 9 and 10 and tank 11 LLC selectors to "00000".

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

After SB 28-048 For A/C 001-005,

8. Functional Test - Pumps Start Control Units

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable communications equipment, service compartment to flight compartment	-
Stopwatch	-
Protective plastic caps,	-

DESCRIPTION	PART NO.
for electrical connectors to control units	

B. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the tank associated with the pump start control unit under test contains not less than 1,000 kg of fuel. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing), as required.

(4) Open the forward service compartment door 123 BB and establish communication between the service compartment and flight compartment.

<u>NOTE</u>: A phone jack point is positioned next to the control units.

C. Test

<u>CAUTION</u>: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

(1) With electrical power on, check at the control unit that -

(a) indicators A, B and C are illuminated, and

(b) indicators 5 and 6 are extinguished.

(2) Set the associated trim PUMP switch to "ON". Check that -

(a) the associated LOW PRESS caption is illuminated and then extinguished within 3 s,

(b) during the first 5 s, the control unit indicators A, B and C go dim and are gradually extinguished, and indicators 5 and 6 remain extinguished,

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(c) at the end of the 5 s period, indicators A, B and C are extinguished, indicator 5 is illuminated and indicator 6 remains extinguished, and

(d) after 6 s, indicators A, B and C remain extinguished, indicator 5 remains illuminated and indicator 6 is illuminated.

WARNING: 200 V 400 Hz THREE-PHASE POWER IS PRESENT AT THE CONTROL UNIT ELECTRICAL CONNECTOR. IMMEDIATELY THE ELECTRICAL CONNECTOR IS DISCONNECTED, FIT A PROTECTIVE PLASTIC CAP OVER THE CONNECTOR.

(3) Disconnect the electrical connector from the front of the control unit. Check that the trim pump continues to run.

(4) Set the associated trim PUMP switch to "AUTO". Check that the trim pump stops running.

(5) Trip the associated pump supply and pump control circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP SUP	14-215	1Q189	C17
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 RH PUMP SUP	13-216	2Q189	B1
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 10 LH PUMP SUP	14-216	1Q190	B1
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 RH PUMP SUP	13-215	2Q190	C19
TANK 10 RH PUMP CONT	13-215	2Q184	B16

(6) Reconnect the electrical connector to the front of the control unit.

(7) Reset the circuit breakers previously tripped.

(8) Repeat operations (1) and (2).

D. Conclusion

(1) Close and secure the service compartment door 123 BB (Ref. 52-41-11).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

9. Functional Test - Automatic Trim Transfer

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-

B. Prepare to Test Automatic Trim Transfer

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required:-

(a) Tank 9 - 4,000 kg

(b) Tank 10 - Full

(c) Tanks 1 and 4 - Full

(d) Tank 11 - 1,000 kg

(e) Remaining tanks - empty, i.e., at unusable level.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(4) Pressurize the green and blue hydraulic systems, using the ground pressurizing system (Ref. 29-23-00).

C. Test Automatic Trim Transfer

NOTE: During this test, it must be ensured that other hydraulic systems/services are not operated.

(1) Set tanks 9 and 10 load limit control (LLC) selector to 13,060 kg.

(2) Set tank 11 LLC selector to 2,000 kg.

(3) Set the TRIM TRANS AUTO MASTER switch to "REARWARD". Check that -

(a) tank 11 LH and RH trim inlet valves open,

(b) tank 9 LH and RH pumps LOW PRESS captions are illuminated and then extinguished,

(c) tank 10 LH and RH pumps LOW PRESS captions are illuminated, and

(d) fuel is seen to be transferring from tank 9 into tank 11.

(4) At panel 4-211, set the FUEL FWD TRANS switch to "O/RIDE". Check that -

(a) tank 11 LH and RH trim inlet valves close,

(b) tank 9 LH and RH trim inlet valves open,

(c) tank 9 LH and RH pumps are heard to stop running but their LOW PRESS captions are not illuminated,

(d) tank 10 LH and RH LOW PRESS captions are extinguished,

(e) all four tank 11 pumps LOW PRESS captions are illuminated and then extinguished, and

(f) fuel is seen to be transferring from tank 11 into tank 9.

(5) Set the FUEL FWD TRANS switch to the 'locked' position. Check that -

(a) tank 11 LH and RH trim inlet valves open,

(b) tank 9 LH and RH trim inlet valves close,

(c) tank 11 pumps stop running but their associated LOW PRESS captions are not illuminated,

(d) tank 9 LH and RH pumps start running,

(e) tank 10 pumps LOW PRESS captions are illuminated,

and

(f) fuel is seen to be transferring from tank 9 into tank 11.

(6) Allow fuel to transfer into tank 11. When tank 11 FQI indicates 2,000(±230) kg, check that -

(a) tank 11 trim inlet valves close,

(b) tanks 5 and 7 trim inlet valves open,

(c) the LLC caption on the FQI control panel is not illuminated, and

(d) fuel is seen to be transferring into tanks 5 and 7.

(7) Allow fuel transfer to continue until tank 9 FQI indicates 1,000(±460) kg; check that -

(a) tank 5 and 7 trim inlet valves close,

(b) tank 9 pumps stop running, but their LOW PRESS captions are not illuminated,

(c) tank 10 LOW PRESS captions are extinguished, and

(d) the LLC caption on the FQI control panel is not illuminated.

(8) Set the TRIM TRANS AUTO MASTER switch to "OFF".

(9) Set tanks 9 and 10 load limit selector to "00000".

(10) Set the TRIM TRANS AUTO MASTER switch to "REARWARD". Check that -

(a) tank 9 LH and RH pumps start running,

(b) tank 10 pumps LOW PRESS captions are illuminated,

(c) tanks 5 and 7 trim inlet valves open, and

(d) fuel is seen to transferring into tanks 5 and 7.

(11) Simultaneously trip the following circuit breakers. Check that -

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 RH PUMP CONT	13-216	2Q181	E3

(a) tank 9 pumps LOW PRESS captions are illuminated, and

(b) after a delay of 3.6 to 4.4 s, tank 10 LOW PRESS captions are extinguished.

(12) Reset the circuit breakers previously tripped. Check that -

(a) tank 9 pumps LOW PRESS captions are extinguished, and

(b) tank 10 pumps continue to run.

(13) Set the TRIM TRANS AUTO MASTER switch to "OFF". Check that -

(a) tanks 9 and 10 pumps stop running and their associated LOW PRESS captions are not illuminated, and

(b) tanks 5 and 7 trim inlet valves close.

(14) Set the TRIM TRANS AUTO MASTER switch to "REARWARD". Check that -

(a) tank 9 pumps start running,

(b) tank 10 LOW PRESS captions are illuminated, and

(c) tanks 5 and 7 trim inlet valves open.

(15) Because the quantity of fuel transferring into tanks 5 and 7 is greater than their total capacity, transfer 700 kg of fuel from tank 5 to tank 2 and 600 kg from tank 7 to tank 3, as follows:-

(a) Set tank 5 main transfer RH PUMPS switch to "ON". Check that fuel is seen to be transferring into tank 2.

(b) Set tank 7 main transfer LH PUMPS switch to "ON". Check that fuel is seen to be transferring into tank 3.

(c) When the receiving tanks contain the required quantity, set the associated main transfer PUMPS switch to "OFF".

(16) When tank 9 pumps LOW PRESS captions are illuminated, check that, after a delay of 3.6 to 4.4 s, tank 10 pumps LOW PRESS captions are extinguished.

(17) Allow fuel transfer to continue until tank 10 empties. When tank 10 FQI indicates 0(+460 -0) kg, check that -

(a) tank 9 and 10 pumps stop running and their associated LOW PRESS captions are not illuminated,

(b) tanks 5 and 7 trim inlet valves close, and

(c) the LLC caption on the FQI control panel is not illuminated.

(18) Set the TRIM TRANS AUTO MASTER switch to "OFF".

(19) Set tanks 9 and 10 LLC selector to 1,500 kg.

(20) Set tank 11 LLC selector to "00000".

(21) Set the TRIM TRANS AUTO MASTER switch to "FORWARD". Check that -

(a) tank 9 trim inlet valves open,

(b) all (four) tank 11 pumps run, and

(c) fuel is seen to be transferring into tank 9.

(22) When tank 9 FQI indicates 1,500(±460 -0) kg, check that -

(a) the LLC caption on the FQI control panel is not illuminated,

(b) tank 9 trim inlet valves close, and

(c) tanks 5 and 7 trim inlet valves open.

(23) Set the FUEL FWD TRANS switch to "O/RIDE". Check

that -

(a) tank 9 trim inlet valves open,

(b) tanks 5 and 7 trim inlet valves close, and

(c) fuel transfers from tank 11 to tank 9.

(24) Allow tank 11 to empty. Check that -

(a) all (four) tank 11 LOW PRESS captions are illuminated and remain so, and

(b) tank 9 trim inlet valves remain open.

(25) Set tank 11 LH, RH GREEN and BLUE pump control switches to "OFF".

(26) Transfer fuel from tanks 5 and 7 into tank 9 as follows:-

(a) Set tank 5 main transfer RH PUMPS switch to "ON". Check that fuel is seen to be transferring into tank 2.

(b) Set tank 7 main transfer LH PUMPS switch to "ON". Check that fuel is seen to be transferring into tank 3.

(c) Set tanks 2 and 3 JETTISON switches to "OPEN".

(d) Set a tank 2 and a tank 3 standby ENGINE FEED pump switch to "ON". Check that fuel is transferring into tank 9.

(27) Allow tank 9 to fill completely (11,210 kg). When tank 9 is full, check that -

(a) tank 9 trim inlet valves close, and

(b) tanks 5 and 7 trim inlet valves open.

(28) Set the FUEL FWD TRANS switch to the 'locked' position. Check that tanks 5 and 7 trim inlet valves close.

(29) Set the TRIM TRANS AUTO MASTER switch to "OFF".

D. Conclusion

(1) Set tanks 2 and 3 standby ENGINE FEED pump switches

to "OFF".

(2) Set tanks 2 and 3 JETTISON switches to "SHUT".

(3) Set tanks 5 and 7 main transfer PUMPS switches to "OFF".

(4) Switch off the ground pressurizing system (Ref. 29-23-00).

(5) Set tanks 9 and 10 LLC selector to "00000".

(6) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(7) Switch off and disconnect electrical ground power as detailed in 24-41-00.

10. Functional Test - Load Limit Control, Zero Locking Inhibition

A. Prepare to Test Load Limit Control, Zero Locking Inhibition

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required:-

(a) Tank 9 - Full

(b) Tanks 1 and 4 - Full

(c) Remaining tanks - empty, i.e., at unusable level.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

B. Test Load Limit Control, Zero Locking Inhibition

(1) Set tanks 9 and 10 LLC selector to 5,000 kg.

(2) Set tank 11 LLC selector to 50 kg.

(3) Inhibit operation of tank 9 trim pumps by tripping the following circuit breakers.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP SUP	14-215	1Q189	C17
TANK 9 RH PUMP SUP	13-216	2Q189	B1

(4) Set the TRIM TRANS AUTO MASTER switch to "REARWARD". Check that -

(a) tank 11 trim inlet valves remain closed,

(b) tank 5 and 7 inlet valves open, and

(c) the LLC caption on the FQI control panel is not illuminated.

(5) Set tank 11 LLC selector to 250 kg. Check that -

(a) tank 11 trim inlet valves open,

(b) tanks 5 and 7 trim inlet valves close, and

(c) the LLC caption on the FQI control panel is not illuminated.

(6) Checking that the trim inlet valve operations occur at a selector setting of between 180 and 0 kg, gradually decrease tank 11 LLC selector setting until -

(a) tank 11 trim inlet valves close, and

(b) tanks 5 and 7 trim inlet valves open.

(7) Set the TRIM TRANS AUTO MASTER switch to "OFF". Check that tanks 5 and 7 trim inlet valves close.

C. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Set tanks 9 and 10 LLC selector to "00000".

(3) Set tank 11 LLC selector to "00000".

(4) Ensure that all fuel management panel switches are at

their normal ground settings (Ref. 28-00-00, Servicing).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

11. Functional Test - Trim Valves High Level Shut-off

A. Equipment and Materials

DESCRIPTION	PART NO.
Safety stay (Ref. 7-11-00), for frame 72	-

B. Prepare to Test Valves High Level Shut-off

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing), as required.

(a) Tank 9 - 10,000 kg

(b) Tank 10 - Full

(c) Tanks 1 and 4 - Full

(d) Tank 5 - 6,500 kg

(e) Tank 8 - 10,000 kg

(f) Tank 7 - 7,000 kg

(g) Tank 11 - 10,000 kg

(h) Remaining tanks - empty, i.e., at unusable level.

(4) Ensure that the refuel valves of the tanks under test have not closed due to high level shut-off action. If

necessary, defuel until the tank refuel valve reopens.

(5) Position the safety stay at frame 72. Adjust the stay to give a nominal gap of 2 in (50 mm) between the stay and fuselage.

(6) Close the refuel control panel access door.

(7) Attach a placard to the refuel control panel door, indicating that tests are being carried out on the fuel system.

(8) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

C. Test Trim Valves High Level Shut-off

CAUTION: WHEN TRANSFERRING FUEL TO TANK 11, MONITOR THE CLEARANCE AT FRAME 72 SAFETY STAY.

(1) Transfer fuel into tank 11, as follows:-

(a) Set tank 11 LH and RH INLET VALVES MAIN switches to "OPEN". Check that the associated magnetic indicator displays change from bar-across-line to diagonal stripes and then to bar-in-line.

(b) Set tank 10 LH and RH PUMPS switches to "ON". Check that the associated LOW PRESS captions are illuminated and then extinguished and fuel is seen to be transferring into tank 11.

(c) Check, by reference to the magnetic indicators, that tank 11 inlet valves automatically close at the correct level (Ref. Table 503).

(d) Set tanks 10 LH and RH PUMPS switches to "OFF".

(e) Set tank 11 LH and RH INLET VALVES MAIN switches to "AUTO".

TANK NO.	CONTENTS INDICATED (kg) AT HLSO (sp. gr. 0.790)
11	10,180 to 10,600
9	10,850 to 11,290

TANK NO.	CONTENTS INDICATED (kg) AT HLSO (sp. gr. 0.790)
5	7,050 to 7,330
7	7,245 to 7,535

Tank Contents at High Level Shut-off
Table 503

(2) Transfer fuel into tank 9, as follows:-

(a) Set tank 9 LH and RH INLET VALVES MAIN switches to "OPEN". Check that the associated magnetic indicator displays change from bar-across-line to diagonal stripes and then to bar-in-line.

(b) Set tank 11 LH and RH PUMPS switches to "ON". Check that the associated LOW PRESS captions are illuminated and then extinguished and fuel is seen to be transferring into tank 9.

(c) Check, by reference to the magnetic indicators, that tank 9 inlet valves automatically close at the correct level (Ref. Table 503).

(d) Set tank 9 LH and RH INLET VALVES MAIN switches to "AUTO".

(3) Transfer fuel into tank 5, as follows:-

(a) Set tank 5 INLET VALVE MAIN switch to "OPEN". Check that the magnetic indicator display changes from bar-across-line to diagonal stripes and then to bar-in-line, and fuel is seen to be transferring from tank 11 to tank 5.

(b) Check, by reference to the magnetic indicator, that tank 5 inlet valve automatically closes at the correct level (Ref. Table 503).

(c) Set tank 5 INLET VALVE MAIN switch to "AUTO".

(4) Transfer fuel into tank 7, as follows:-

(a) Set tank 7 INLET VALVE MAIN switch to "OPEN". Check that the magnetic indicator display changes

from bar-across-line to diagonal stripes and then to bar-in-line, and fuel is seen to be transferring from tank 11 to tank 7.

(b) Check, by reference to the magnetic indicator, that tank 7 inlet valve automatically closes at the correct level (Ref. Table 503).

(c) Set tank 7 INLET VALVE MAIN switch to "AUTO".

(d) Set tank 11 LH and RH PUMPS switches to "OFF".

D. Conclusion

(1) Redistribute fuel in the aircraft tanks to maintenance requirements.

(2) Remove the safety stay from frame 72.

(3) Remove the placard from the refuel control panel door.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

12. Flow Test - Trim Transfer System

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Safety stay (Ref. 7-11-00), for frame 72	-

B. Prepare to Flow-test Trim Transfer System

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Set the fuel tank quantities as follows, refuelling (Ref. 12-11-28), defuelling (Ref. 28-25-00) or transferring fuel (Ref. 28-00-00, Servicing) as required.

(a) Tank 9 - Full

(b) Tank 10 - Full

(c) Tanks 1 and 4 - Full

(d) Remaining tanks - empty, i.e., at unusable level.

(4) Position the safety stay at frame 72. Adjust the stay to give a nominal gap of 2 in (50 mm) between the stay and fuselage.

(5) Close the refuel control panel access door.

(6) Attach a placard to the refuel control panel door, indicating that tests are being carried out on the fuel system.

(7) Pressurize the green and blue hydraulic systems, using the ground pressurizing system (Ref. 29-23-00).

C. Flow-test Trim Transfer System

CAUTION: TO REDUCE PRESSURE SURGES IN THE MAIN TRIM TRANSFER PIPES, DO NOT SWITCH ON THE TRIM PUMPS IN TANKS 9 AND 10 BEFORE AN ASSOCIATED LH OR RH TRIM INLET VALVE IS OPENED.

After SB 28-048 For A/C 001-005,

CAUTION: TANKS 9 AND 10 TRIM PUMPS MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

NOTE: During this test, it must be ensured that other hydraulic systems/services are not operated.

(1) Transfer fuel to the tank(s) in the sequence and quantities as detailed in Table 504, observing the following points:-

(a) Check the correct operation of each valve by reference to its associated magnetic indicator.

(b) Check that the associated pumps LOW PRESS

captions are illuminated and then extinguished when the pumps are switched on.

(c) Using the stopwatch and FQIs, check that the flow rates are in accordance with Table 505.

(d) As soon as the required fuel quantity has been transferred, shut the associated inlet valve and switch off the pump(s).

OPER-ATION NO.	INITIAL SETTING INLET VALVE	PUMP SWITCH	TRANSFER QUANTITY (kg)	FINAL SETTING INLET VALVE	PUMP SWITCH
(1)	Tank 11 LH MAIN "OPEN"	Tank 9 LH "ON"	3,000	Tank 11 LH MAIN "SHUT"	Tank 9 LH "OFF"
(2)	Tank 11 RH MAIN "OPEN"	Tank 9 RH "ON"	3,000	Tank 11 RH MAIN "SHUT"	Tank 9 RH "OFF"
(3)	Tank 9 RH MAIN "OPEN"	Tank 11 BLUE "ON"	1,000	Tank 9 RH MAIN "SHUT"	Tank 11 BLUE "OFF"
(4)	Tank 9 LH MAIN "OPEN"	Tank 11 GREEN "ON"	1,000	Tank 9 LH MAIN "SHUT"	Tank 11 GREEN "OFF"
(5)	Tank 9 LH MAIN "OPEN"	Tank 11 LH "ON"	1,000	Tank 9 LH MAIN "SHUT"	Tank 11 LH "OFF"
(6)	Tank 9 RH MAIN "OPEN"	Tank 11 RH "ON"	1,000	Tank 9 RH MAIN "SHUT"	Tank 11 RH "OFF"
(7)	Set tank 11 fuel quantity to 7,000 kg by transferring 5,000 kg from tank 9.				
(8)	Tank 9 RH MAIN "OPEN"	Tank 11 RH and BLUE "ON"	2,000	Tank 9 RH MAIN "SHUT"	Tank 11 RH "OFF"

OPER-ATION NO.	INITIAL SETTING INLET VALVE	PUMP SWITCH	TRANSFER QUANTITY (kg)	FINAL SETTING INLET VALVE	PUMP SWITCH
(9)	Tank 9 LH MAIN "OPEN"	Tank 11 LH and GREEN "ON"	2,000	Tank 9 LH MAIN "SHUT"	Tank 11 LH and GREEN "OFF"
(10)	Tank 5 MAIN "OPEN"	Tank 9 LH "ON"	2,000	Tank 5 MAIN "SHUT"	Tank 9 LH "OFF"
(11)	Tank 7 MAIN "OPEN"	Tank 9 RH "ON"	2,000	Tank 7 MAIN "SHUT"	Tank 9 RH "OFF"
(12)	Tank 5 MAIN "OPEN"	Tank 10 LH "ON"	2,000	Tank 5 MAIN "SHUT"	Tank 10 LH "OFF"
(13)	Tank 7 MAIN "OPEN"	Tank 10 RH "ON"	2,000	Tank 7 MAIN "SHUT"	Tank 10 RH "OFF"
(14)	Tank 5 MAIN "OPEN"	Tank 11 GREEN "ON"	1,000	Tank 5 MAIN "SHUT"	Tank 11 GREEN "OFF"
(15)	Tank 7 MAIN "OPEN"	Tank 11 BLUE "ON"	1,000	Tank 7 MAIN "SHUT"	Tank 11 BLUE "OFF"

Flow Test Sequence Chart
Table 504

TANK-TO-TANK FUEL FLOW	PUMP(S) OPERATING	FLOW RATE (kg/min)	TRANSFERRING TIME
9 - 11 9 - 11	9 LH 9 RH	352 to 421	7 min 7.5 s to 8 min 31 s
11 - 9 11 - 9	11 BLUE 11 GREEN	367 to 400	2 min 30 s to 2 min 43.5 s

TANK-TO-TANK FUEL FLOW	PUMP(S) OPERATING	FLOW RATE (kg/min)	TRANSFERRING TIME
11 - 9 11 - 9	11 LH 11 RH	383 to 417	2 min 23.9 s to 2 min 36.7 s
11 - 9 11 - 9	11 RH and BLUE 11 LH and GREEN	583 to 633	3 min 9.6 s to 3 min 25.8 s
9 - 5	9 LH	700 to 767	2 min 36.4 s to 2 min 51.4 s
9 - 7	9 RH	633 to 700	2 min 51.4 s to 3 min 9.6 s
10 - 5	10 LH	767 to 833	2 min 24.1 s to 2 min 36.4 s
10 - 7	10 RH	642 to 708	2 min 49.5 s to 3 min 6.9 s
11 - 5	11 GREEN	367 to 400	2 min 30 s to 2 min 43.5 s
11 - 7	11 BLUE	375 to 408	2 min 27.1 s to 2 min 40 s

Flow Rates
Table 505

D. Conclusion

(1) Switch off the ground pressurizing system (Ref. 29-23-00).

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(4) Remove the safety stay from frame 72.

(5) Remove the warning placard from the refuel control panel access door.

13. <u>Trim Pipes Leakage Test - Zone 153/4 (Ref. Fig. 502)</u>

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NOTE: THE PANEL REFERENCES IN BRACKETS ARE THOSE OF THE CORRESPONDING PANELS IN THE RIGHT WING

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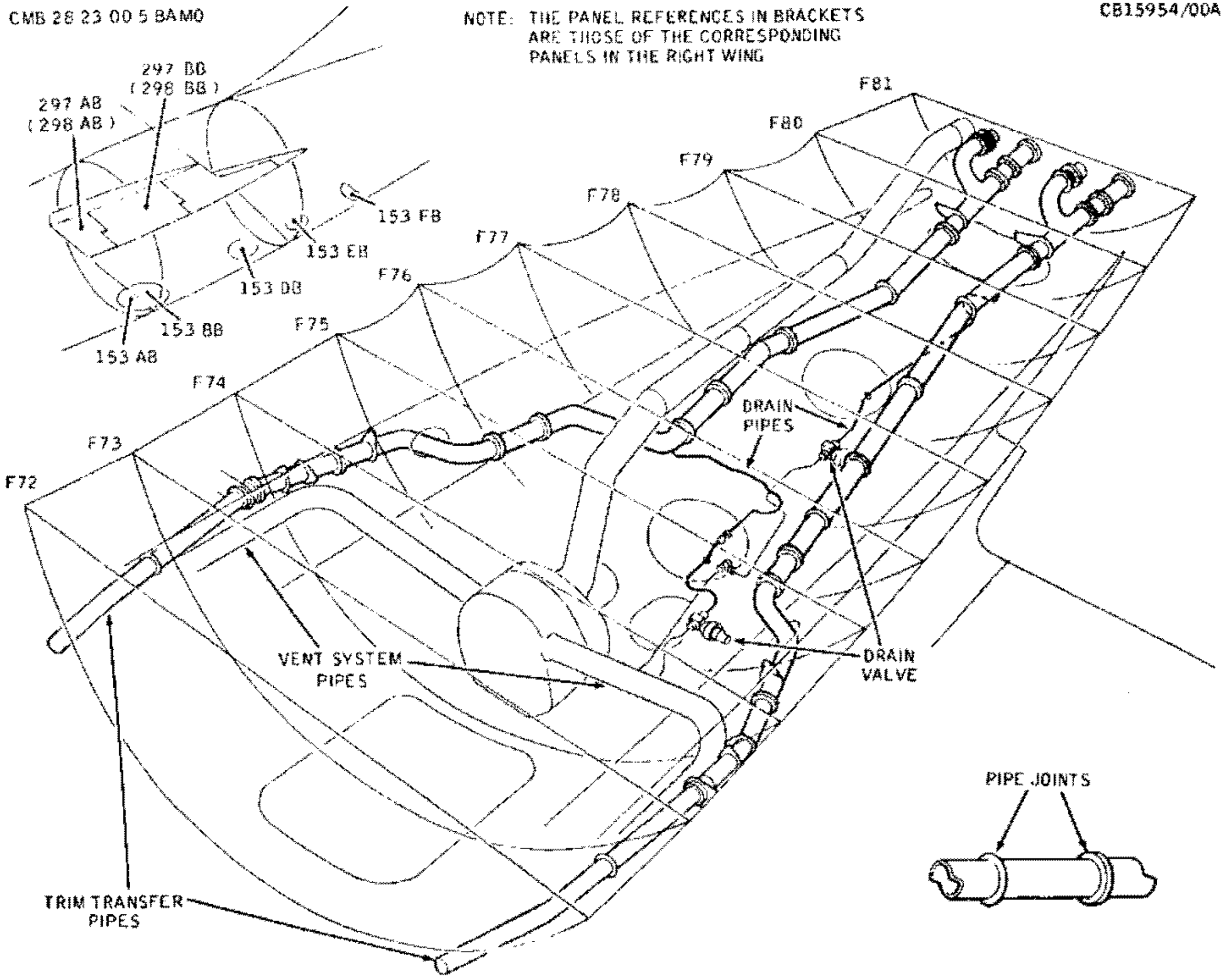

Fuel Pipes - Zone 153/4
Figure 502

A. Prepare to Test Trim Pipes for Leakage

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) To enable the trim pipes to be pressurized with fuel, ensure that there is adequate fuel in tanks 9 and 10. Refuel (Ref. 12-11-28), if required.

(4) Ensure that the aircraft fuel distribution is satisfactory (Ref. 12-00-10).

(5) Open access panel doors 153 FB, 153 EB, 153 DB, 153 BB, and 153 AB (Ref. Fig. 502).

(6) Remove panels 297 AB, 297 BB, 298 AB and 298 BB (Ref. Fig. 502).

NOTE: As the securing bolts are of different lengths, the positions from which the bolts are removed must be noted.

(7) Ensure that the refuel control panel access door is closed.

(8) Attach placards to the refuel control panel door and fuel management panel, warning that a test is in progress and that the position of the switches must not be altered.

B. Test Trim Pipes for Leakage

(1) Prime the trim pipes with fuel, as follows:-

(a) Set tank 11 LH and RH INLET VALVES MAIN switches to "OPEN". Check that the associated magnetic indicator displays change from bar-across-line to diagonal stripes and then to bar-in-line.

(b) Set tank 10 LH and RH PUMP switches to "ON". Check that the associated LOW PRESS captions are illuminated and then extinguished.

(c) To fully prime the trim pipes, allow at least 10 s of pump running time.

(d) Set tank 11 LH and RH INLET VALVES MAIN switches

to "SHUT". Check that the associated magnetic indicator displays change from bar-in-line to diagonal stripes and then to bar-across-line.

(e) Set the TRIM PIPE DRAIN switch to "OPEN" for 5 s only. Check that the associated magnetic indicator displays change from SHUT to diagonal stripes and then to "OPEN".

NOTE: The scavenge pump will operate for a short period.

(f) Set the TRIM PIPE DRAIN switch to "SHUT". Check that the associated magnetic indicator displays change from OPEN to diagonal stripes and then to SHUT.

(2) Allow the trim pumps to pressurize the trim pipes for a period not less than 15 min.

(3) During the 15 min period, continually check the joints and piping of the main trim pipes and trim drain pipes (Ref. Fig. 502), for freedom from leaks.

NOTE: For information on pipe joints in this area refer to Removal/Installation.

C. Conclusion

(1) Set tank 10 LH and RH PUMP switches to "OFF".

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(4) Remove the placards from the fuel management panel and refuel control panel door.

(5) Close the access panel doors 153 FB, 153 EB, 153 DB, 153 BB and 153 AB, and secure them with their quick-release fasteners.

(6) Refit panels 297 AB, 297 BB, 298 AB and 298 BB. Refit the bolts in the positions previously noted. Torque-tighten the bolts to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

14. Pipeline Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel test rig, capable of 100 psig (6.8 bar) delivery pressure	-
Valve dummy element	E925117000
Blank, for thermal relief valves	E925132000

B. Prepare to Test Pipeline for Leakage

(1) Ensure that all fuel management panel and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00, Servicing.

(3) Remove a trim transfer inlet valve element from any convenient location (Ref. 28-23-21, Removal/Installation).

(4) Fit a valve dummy element in place of the valve element just removed. Ensure that the valve dummy element is orientated to allow pressurization of the trim transfer pipe.

(5) Connect the test rig to the adapter on the dummy element.

(6) Prime the trim transfer pipe with fuel as follows:

(a) Supply fuel from the test rig at 10 psig (0.68 bar).

(b) Individually set each INLET VALVE MAIN switch (Ref. Fig.501) (except the switch for the valve which has the dummy element fitted) to "OPEN" for 10 s and then to "AUTO".

(7) Defuel and drain tanks 5 and/or 8 and any other tanks that contain sections of the pipe to be tested (Ref. 28-25-00, Servicing).

<u>WARNING:</u> OBSERVE THE PRECAUTIONS FOR ENTERING FUEL TANKS, DETAILED IN 28-10-00, SERVICING.

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(8) Gain access to the thermal relief valves (Ref. 28-23-22, Removal/Installation) by removing the access panel (524 AB - tank 5 and/or 624 AB - tank 8).

(9) Fit the blank to the thermal relief valves.

C. Test Pipeline for Leakage

(1) Using the test rig, slowly pressurize the pipeline to 100 psig (6.8 bar).

(2) Hold the pressure for a period of 15 min. During this period, check all pipes/joints/connections for freedom from leaks.

R R R R NOTE: After fuel pipe replacement a visual check of the joints whilst subjected to full refuel bowser pressure (50 - 55 psig) with all refuel and trim transfer valves shut is acceptable.

D. Conclusion

(1) Slowly release the pressure at the test rig.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

(3) Remove the valve dummy element and refit the trim transfer inlet valve element (Ref. 28-23-21, Removal/Installation).

(4) Disconnect the dummy element from the test rig.

(5) Remove the blanks from the thermal relief valves.

(6) Examine for freedom from corrosion the mating bonding surfaces of the wing, the clamp rings (where applicable) and the access panels that were removed.

(7) Refit the access panels.

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R 15. Alternative Pipeline Leakage Check Using Front Trim Pumps

R WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT TANK 11 TO BE REFUELLED WITHOUT AIRCRAFT OVERBALANCE OCCURRING. FOR MOST AIRCRAFT ZERO FUEL WEIGHTS AND ZERO FUEL CG'S, TANKS 10, 1 AND 4 WILL HAVE TO BE FULL AND TANKS 2, 3, 5, 5A, 6, 7, 7A AND 8 EMPTY. PRIOR TO THE TEST TANK 9 SHOULD CONTAIN APPROX. 5000 KG AND TANK 11 SHOULD BE EMPTY.

R A. Procedure

R (1) Ensure that all fuel management panel and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (2) Make available electrical ground power as detailed in 24-41-00, Servicing.

R (3) OPEN Tank 11 inlet valve on side to be tested. Check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes, and then to bar-in-line.

R (4) Set the Tank 9 pump switch on the side under test to ON and check that the LOW PRESS caption illuminates, and then extinguishes after 3 seconds.

R (5) Confirm that fuel is entering Tank 11, as indicated by that tank's contents indicator, then CLOSE Tank 11 inlet valve, check that associated magnetic indicator display changes from bar-in-line to diagonal stripes, and then to bar-across-line, and confirm by means of the contents indicators that fuel transfer has ceased.

R (6) Inspect appropriate trim transfer pipes and couplings for leakage over a period of 15 min whilst the pipes remain pressurized from the Tank 9 pump.

R (7) Set the Tank 9 pump switch to "OFF".

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TRIM TRANSFER SYSTEM - APPROVED REPAIRS

1. General

NOTE: When manufacturing new pipes, L.56 is an approved alternative for AG.3 material.

INLET VALVE (TRIM TRANSFER) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILS IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The inlet valves are part of the trim transfer system (Ref. 28-23-00) and are installed in the associated fuel tanks (Ref. Table 401). An inlet valve comprises a motorized valve element and a canister in which it is mounted. The valve element is a spherical plug valve driven through a gearbox by twin but independent electrical motors.

The procedures detailed below deal separately with the removal/installation of the valve element, the twin motor unit and the canister. The valve element may be removed without draining the associated fuel tank but to remove the canister the tank must first be drained.

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2. Valve Element (Ref. Fig.401)

A. Equipment and Materials

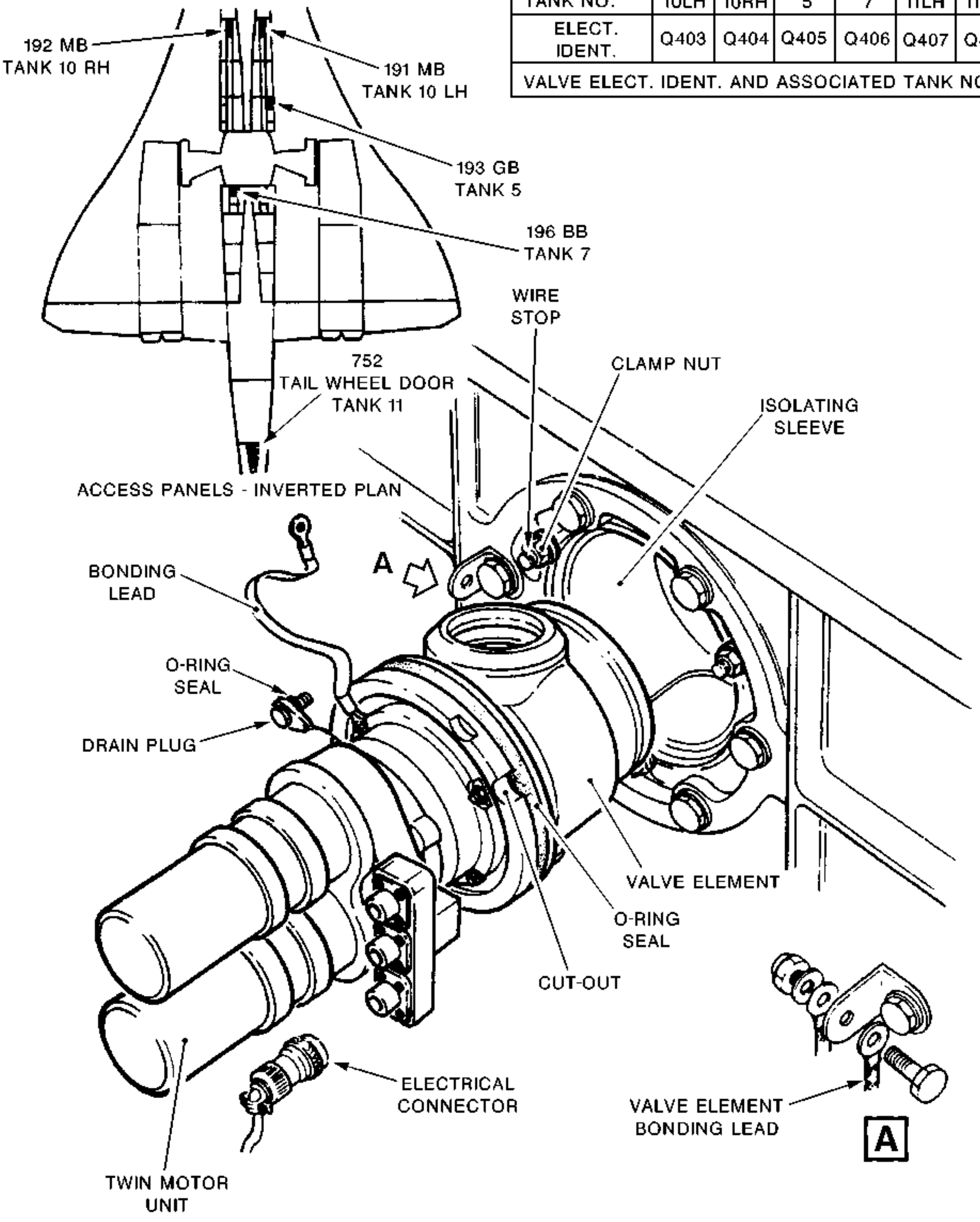
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 10 to 14 lbf in (0.11 to 0.16 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

B. Prepare to Remove Element

(1) Remove the appropriate access panel (Ref. Table 401).

(2) Ensure that the fuel management panel switches are in their normal ground positions (Ref. 28-00-00, Servicing), and that the refuelling control access panel is closed. Place on each panel a placard warning that the positions of the switches must not be changed.

TANK NO.	10LH	10RH	5	7	11LH	11RH
ELECT. IDENT.	Q403	Q404	Q405	Q406	Q407	Q408
VALVE ELECT. IDENT. AND ASSOCIATED TANK NOS.						



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Inlet Valve - Typical Installation
Figure 401

VALVE LOCATION	ACCESS PANEL
Tank 5	193 FB
Tank 7	196 BB
Tank 10 RH	192 MB
Tank 10 LH	191 MB
Tank 11 RH	752, tail wheel door
Tank 11 LH	752, tail wheel door

Valve Location and Access Panels
Table 401

(3) Trip the associated supply circuit breakers and fit safety clips.

NOTE: The valve elements located in tank 10 are the inlet valves of tank 9.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5 INLET VALVE MAIN SUP	15-215	Q 363	G20
TANK 5 INLET VALVE O/RIDE SUP	3-213	Q 369	E 6
TANK 7 INLET VALVE MAIN SUP	15-216	Q 364	D 5
TANK 7 INLET VALVE O-RIDE SUP	1-213	Q 370	J14
TANK 9 LH INLET VALVE MAIN SUP	15-215	Q 361	G19
TANK 9 LH INLET VALVE O/RIDE SUP	3-213	Q 367	E 5
TANK 9 RH INLET VALVE MAIN SUP	15-216	Q 362	D 4
TANK 9 RH INLET VALVE O/RIDE SUP	1-213	Q 368	J13

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q 365	G21
TANK 11 LH INLET VALVE O/RIDE SUP	3-213	Q 371	E 7
TANK 11 RH INLET VALVE MAIN SUP	15-216	Q 366	D 6
TANK 11 RH INLET VALVE O/RIDE SUP	1-213	Q 372	J15

C. Remove Element

(1) Disconnect the electrical connectors from the valve element.

(2) Disconnect the bonding lead from the mounting structure by removing the securing bolt and washer or nut, bolt and washer, as applicable.

(3) Slacken off the drain plug in the valve element sufficiently to facilitate subsequent removal.

CAUTION: DO NOT SLACKEN OFF THE CLAMP NUTS MORE THAN TWO TURNS OR THE WIRE STOPS IN THE CLAMP NUT STUDS MAY BE DAMAGED.

(4) Slacken off the clamp nuts between 1 1/2 and 2 turns and then rotate the valve element clockwise through 90 deg. Support it in this position.

(5) Place a suitable container below the valve element then remove the drain plug and drain the fuel (approx. 1 pint) (0.57 l) from the unit.

(6) With the valve element cut-outs aligned with the clamps, withdraw the unit from the canister.

(7) Remove and discard the O-ring seal from the valve element flange.

(8) Temporarily fit the drain plug to the valve element.

(9) Fit a suitable blank to the canister aperture.

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D. Install Element

NOTE: O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blank from the canister aperture.

(3) Remove the drain plug from the valve element then, using a new O-ring seal, refit the drain plug. Torque-tighten it to between 10 and 14 lbf in (0.11 and 0.16 mdaN) and wire-lock it in accordance with 20-21-13.

CAUTION: FOR THE TANK 5 INSTALLATION: IF THE TANK 5 INTERCONNECT VALVE (REF. 28-22-24) HAS ALSO BEEN REMOVED, CARE MUST BE TAKEN TO ENSURE THAT THE VALVE ELEMENTS ARE NOT TRANSPOSED DURING INSTALLATION. NOTE THAT THE TRIM TRANSFER INLET VALVE HAS A TWIN MOTOR WITH THREE ELECTRICAL CONNECTORS AND THE INTERCONNECT VALVE HAS A SINGLE MOTOR WITH ONLY ONE ELECTRICAL CONNECTOR.

(4) Fit a new O-ring seal to the valve element and then insert the element into the canister, ensuring that the cut-outs are aligned with the clamps.

(5) Rotate the valve element counter-clockwise through 90 deg to align the recesses with the clamps. Torque-tighten the clamp nuts evenly to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Connect and secure the bonding lead to the support structure with the washer and bolt or nut, washer and bolt, as applicable. Check that the valve is bonded in accordance with 20-27-11.

(7) Connect the electrical connectors to the valve element, ensuring that the mating surfaces are clean and undamaged.

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E. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

(3) Fit the panels removed to gain access to the valve.

(4) Remove the warning placards.

3. Twin Motor Unit (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.32 to 0.36 mdaN)	-

B. Prepare to Remove Motor Unit

(1) Remove the valve element (Ref. para.2.).

C. Remove Motor Unit

(1) Remove the nuts securing the motor unit to the studs on the valve, then disconnect the bonding lead from the stud.

(2) Disengage the motor unit from the valve drive shaft and withdraw the motor unit.

D. Install Motor Unit

(1) Ensure that the mating faces of the valve and motor unit are clean and undamaged and that the splines on the drive shaft and motor coupling are clean and free from burrs.

(2) Align the master splines of the drive shaft and motor coupling. Then insert the shaft into the coupling and locate the motor unit on the valve by means of the locating dowel on the joint face and the studs.

(3) Connect the bonding lead to the stud and secure it and the valve motor unit with the nuts. Torque-tighten the nuts evenly to between 28 and 32 lbf in (0.32 and 0.36 mdaN).

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E. Conclusion

(1) Install the valve element (Ref. para.2.).

4. Canister (Ref. Fig.402)

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-

B. Prepare to Remove Canister

(1) Remove the valve element (Ref. para.2.).

(2) Defuel the associated fuel tank (Ref. 28-25-00, Servicing).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(3) Drain the trim transfer pipe as follows:

(a) Position a clean container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

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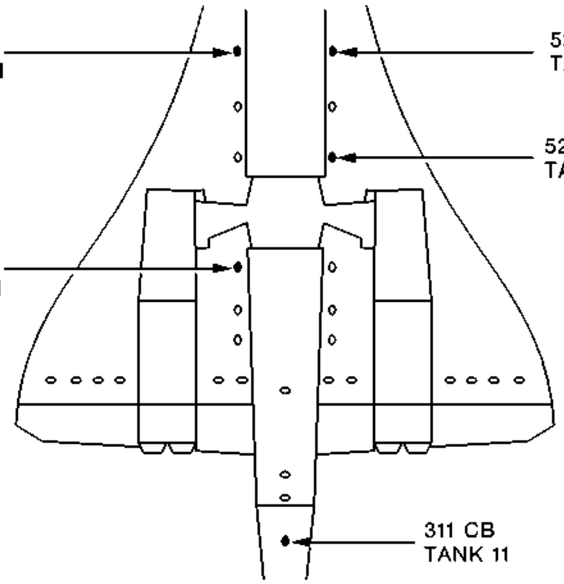
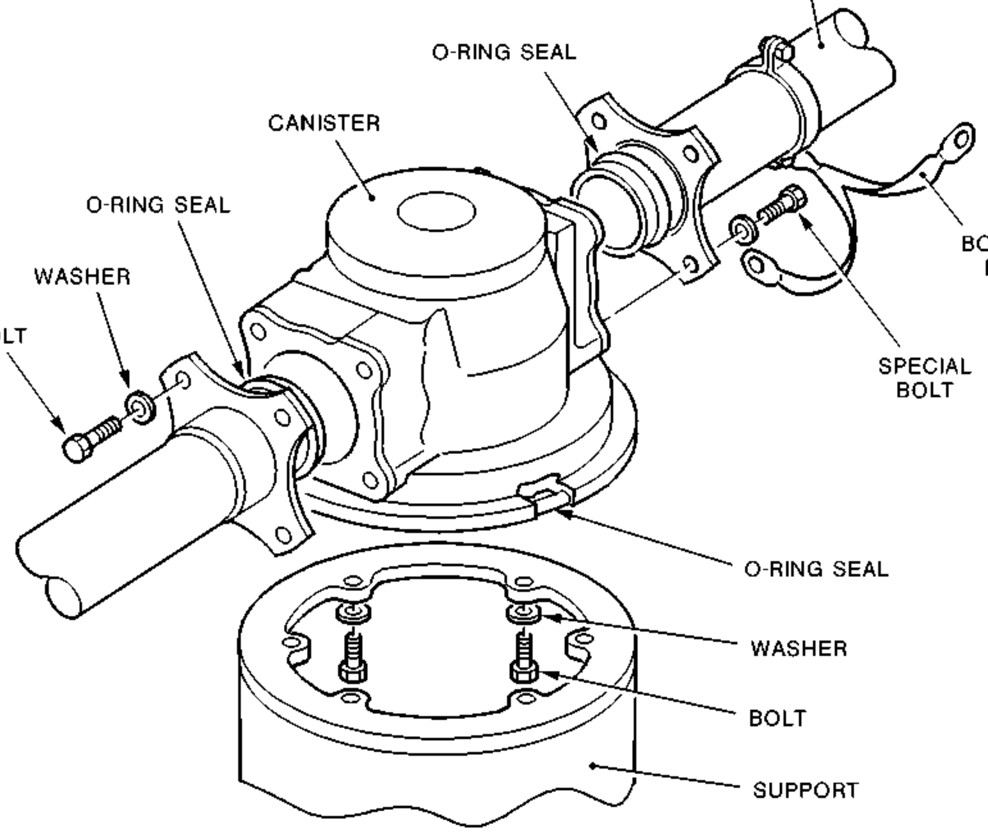


ACCESS PANELS - INVERTED PLAN



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Canister - Typical Installation
Figure 402

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line and then set the switches to "OFF".

(f) Remove the container.

(4) Remove the appropriate access panel (Ref. Table 402).

CANISTER	ACCESS PANEL
Tank 5	524 AB
Tank 7	625 AB
Tank 10 RH	622 AB
Tank 10 LH	522 AB
Tank 11 RH	311 CB
Tank 11 LH	311 CB

Canister Access Panels
Table 402

(5) Gain access to the tank 11 canisters by entering the tank and removing the appropriate aft baffle plates.

C. Remove Canister

(1) Disconnect the fuel pipes from the canister assembly by removing the bolts and washers. Note the position of the bonding leads and the special attachment bolts. Discard the O-ring seals.

(2) Remove the bolts and washers securing the canister and withdraw the canister assembly. Discard the O-ring seal at the base of the canister.

(3) Fit suitable blanks to the canister and the fuel pipes.

D. Install Canister

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the fuel pipes and canister.

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(3) Ensure that the mating faces of the canister, the support and the fuel pipe flanges are clean and undamaged.

(4) Lubricate new O-ring seals in accordance with 20-23-11 and fit them to the canister base and the fuel pipes.

(5) Ensure that the canister sleeve is in the shut position and secure the canister with the bolts and washers.

NOTE: If the canister is not correctly positioned an extension of the top flange of the canister will foul one of the clamp nuts on the canister.

(6) Torque-tighten the canister bolts evenly to between 45 and 55 lbf in (0.508 and 0.621 mdaN). At tank 11, wire-lock the securing bolts in pairs, as detailed in 20-21-13.

(7) Connect the fuel pipes to the canister and secure them with the bolts and washers. Ensure that the bonding leads and special earthing bolts are fitted in the positions previously noted. Torque-tighten all the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN). At tank 11, wire-lock the bolts as detailed in 20-21-13.

E. Conclusion

(1) Check that the bonding-to-structure of the components that have been disturbed is in accordance with 20-27-11.

(2) Carry out a Functional Test of the canister as detailed in Adjustment/Test.

(3) Refit the tank 1 baffle plates, if removed.

R (4) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (5) Fit the access panel removed to gain access to the canister. Ensure that the mating faces are clean and lightly coated with Aeroshell grease No.16, DTD 900/4841.

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R (6) Install the valve element (Ref. para.2.).

R (7) Refuel the tank (Ref. 12-11-28) and check for leakage round the canister and the canister access panel.

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INLET VALVE (TRIM TRANSFER) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

B FUEL TRIM TRANSFER INLET VALVES SHOULD REMAIN SHUT AT ALL
B TIMES, EXCEPT WHEN BEING OPERATED FOR A SPECIFIC MAINTEN-
B ANCE TASK. ENSURE VALVES ARE SHUT BEFORE VACATING FLIGHT
B DECK.
B NOSE GEAR SHOCK ABSORBER EXTENSION IS A GOOD INDICATION OF
B AIRCRAFT OVERBALANCE AND SHOULD NEVER EXCEED 23.5 INS
B (596 MM).

1. General

The six inlet valve units installed in the trim transfer system are identical, each comprising a valve element mounted in an isolation canister. Each element consists of two electric motors (one main and one standby), a spherical valve and a gearbox. Either motor may be used to operate the valve by means of a final drive shaft which is common to both motors. At the fuel management panel (third crew member's station), two separate switches, marked INLET VALVES MAIN and INLET VALVES O/RIDE, control each valve's main and standby motors respectively. A magnetic indicator, near each pair of switches, and a mechanical indicator in the valve element housing provide an indication of valve position.

This topic comprises a Functional Test of the valve element and a Leakage Test of the valve canister. System and Operational Tests are not applicable.

Tank 11 LH (trim) inlet valve also functions as a refuel tank inlet valve. If this valve is under test, the Functional Tests in paragraphs 2. and 3. apply.

2. Functional Test - Valve Element

A. Prepare

CAUTION: OBSERVE THE FUEL DISTRIBUTION SAFETY PRECAUTIONS DETAILED IN 12-00-10, AIRCRAFT GROUND STABILITY.

OBSERVE THE FUEL TRANSFER SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING, 'FUEL TRANSFER ON THE GROUND'.

(1) Ensure that tank 9 (for testing a valve in tank 5, 7 or 11) or tank 11 (for testing a valve in tank 9) contains at least 5,000 kg of fuel. Refuel (Ref. 12-11-28) or transfer fuel, as required.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Ensure that the FUEL FWD TRANS switch on the pilots' roof panel is in the locked position.

(5) Remove the appropriate access panel (Ref. Table 501 and Removal/Installation, Fig.401) to gain access to the valve. For a tank 11 valve, fit a locking sleeve to the tail wheel jack (Ref. 12-37-00, Tail Gear Wheel).

VALVE LOCATION	ACCESS PANEL
Tank 5	193 GB
Tank 7	196 BB
Tank 10, RH	192 MB
Tank 10, LH	191 MB
Tank 11, RH and LH	752, tail wheel door

Valve Location and Access Panels
Table 501

B. Test

(1) Set the appropriate INLET VALVES O/RIDE switch to "OPEN"; check that -

(a) the associated magnetic indicator display changes from bar-across-line to diagonal stripes, then to bar-in-line within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes

from SHUT to OPEN indication.

CAUTION: DO NOT LET THE O/RIDE SWITCH DWELL AT THE "OFF" POSITION WHEN MOVING IT FROM "OPEN" TO "SHUT", OTHERWISE THE VALVE MAY BE SHUT BY THE MAIN MOTOR, AND SO OBSCURE A FAULT IN THE MOTOR UNDER TEST.

(2) Set the INLET VALVES O/RIDE switch to "SHUT"; check that -

(a) the associated magnetic indicator display changes from bar-in-line to diagonal stripes, then to bar-across-line within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes from OPEN to SHUT indication.

(3) Set the INLET VALVES O/RIDE switch to "OFF"; check that -

(a) the associated magnetic indicator display remains bar-across-line, and

(b) the mechanical indicator on the valve remains at SHUT indication.

(4) Set the appropriate INLET VALVES MAIN switch to "OPEN"; check that -

(a) the associated magnetic indicator display changes from bar-across-line to diagonal stripes, then to bar-in-line within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes from SHUT to OPEN indication.

NOTE: If the fuel level in the tank associated with the valve under test is at 'high level', the valve will not open when the INLET VALVES MAIN switch is set to OPEN but it will do so when the O/RIDE switch is set to OPEN.

(5) Set the INLET VALVES MAIN switch to "SHUT"; check that -

(a) the associated magnetic indicator display

changes from bar-in-line to diagonal stripes, then to bar-across-line within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes from OPEN to SHUT indication.

(6) Set the INLET VALVES MAIN switch to "AUTO"; check that -

(a) the associated magnetic indicator display remains bar-across-line, and

(b) the mechanical indicator on the valve remains at SHUT indication.

(7) Set the appropriate INLET VALVES MAIN switch to "OPEN" and set the associated PUMP switch to "ON". Check that the fuel transfer flow rate through the valve is within the limits specified in Table 502.

INLET VALVE SWITCH	TRANSFER TANKS	ASSOCIATED PUMP SWITCH	FLOW RATE (kg/min)
Tank 5	9 to 5	Tank 9, LH	700 to 767
Tank 7	9 to 7	Tank 9, RH	633 to 700
Tank 9, RH	11 to 9	Tank 11, RH	383 to 417
Tank 9, LH	11 to 9	Tank 11, LH	383 to 417
Tank 11, RH	9 to 11	Tank 9, RH	352 to 421
Tank 11, LH	9 to 11	Tank 9, LH	352 to 421

Transfer Flow Rates
Table 502

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Refit the access panel, or remove the locking sleeve from the tail wheel jack (Ref. 12-37-00, Tail Gear Wheel), as applicable.

3. Functional Test - Valve Element (Tank 11, LH)

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the fuel in tank 11 is below high level. Defuel (Ref. 28-25-00, Servicing) if necessary.

(4) Fit a locking sleeve to the tail wheel jack (Ref. 12-37-00, Tail Gear Wheel).

(5) Open the refuel control panel access door and set the refuel master switch to "SET UP".

B. Test

(1) On the refuel control panel, set tank 11 refuel inlet valve control switch to "OPEN" and check that -

(a) the associated magnetic indicator display changes from black to yellow within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes from SHUT to OPEN indication.

(2) Set the switch to "SHUT" and check that -

(a) the associated magnetic indicator display changes from yellow to black within 2 s from the operation of the switch, and

(b) the mechanical indicator on the valve changes from OPEN to SHUT indication.

C. Conclusion

(1) Set the refuel master switch to "OFF-DEFUEL" and close the refuel control panel access door.

(2) Remove the locking sleeve from the tail wheel jack (Ref. 12-37-00, Tail Gear Wheel).

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test - Valve Canister

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing), and that all refuel inlet valve switches on the refuel control panel are set to SHUT. Place placards at the panels warning that the positions of the switches must not be altered.

(2) Defuel and drain the tank which contains the canister (Ref. 28-25-00, Servicing).

(3) Open the appropriate tank access panel (Ref. Table 503 and Removal/Installation, Fig.402) to gain access to the canister.

CANISTER	ACCESS PANEL	ASSOCIATED PUMP SWITCH
Tank 5	524 AB	Tank 9, LH
Tank 7	625 AB	Tank 9, RH
Tank 10, RH	522 AB	Tank 9, RH
Tank 10, LH	622 AB	Tank 9, LH
Tank 11, RH	311 CB	Tank 9, RH
Tank 11, LH	311 CB	Tank 9, LH

Canister Access Panels and Pump Switches
Table 503

(4) Make available electrical ground power as detailed in 24-41-00.

(5) At the fuel management panel, proceed as follows in order to pressurize the trim transfer pipeline to the canister:-

(a) Check, by reference to the fuel quantity indicators, that tank 9 contains at least 1,000 kg of fuel. Refuel the tank (Ref. 12-11-28) if necessary.

(b) For testing a canister in tank 10, set the appropriate LH or RH tank 9 INLET VALVES MAIN switch to "OPEN" and check that the magnetic indicator displays bar-in-line. Check that all other trim inlet valve indicators display bar-across-line.

(c) For testing a canister in tank 5, 7 or 11, check that all trim inlet valve indicators display bar-across-line.

(d) Set the appropriate LH or RH PUMP switch to "ON" (Ref. Table 503) and check that the LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

B. Test

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(1) Enter the tank and check, over a minimum period of 5 min, that there is no fuel leakage from the pipe-to-canister and canister-to-tank joints.

(2) Set the PUMP switch to "OFF".

(3) Refit the tank access panel as detailed in 53-00-00 or 57-00-00, Removal/Installation.

WARNING: OBSERVE THE FUEL LOAD DISTRIBUTION LIMITATIONS DETAILED IN 28-25-00, SERVICING, WHEN REFUELLING OR TRANSFERRING FUEL.

(4) Refuel the tank (Ref. 12-11-28) to high level and check that there is no fuel leakage from the access panel joint.

(5) Remove the valve element (Ref. Removal/Installation).

(6) Check that the external fuel leakage from the canister does not exceed 7.6 cc/min.

(7) Install the valve element (Ref. Removal/Installation).

(8) Check that there is no fuel leakage from the valve-to-canister joint.

C. Conclusion

(1) Carry out a Functional Test of the valve element

(Ref. para.2.).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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THERMAL RELIEF VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four thermal relief valves are fitted, two in each refuelling T-pipe above the refuel control units (RCUs). The valves are provided to relieve fuel pressure, caused by thermal expansion, in the trim transfer pipes when all valves are closed.

A cover plate, bolted to a blanking plate at the top of the T-pipe, holds the valves in position.

Access to the valve is gained after removal of the appropriate RCU.

2. Thermal Relief Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
R Viton Sealant PR 1720SM	Product No.351 (Ref. 20-30-00) R
R Cleaning solvent, BAC.M 302	Product No.473 (Ref. 20-30-00) R

B. Prepare

(1) Defuel (Ref. 28-25-00, Servicing), the associated tank (tank 5, LH valves; tank 8, RH valves).

(2) Remove the associated RCU (Ref. 28-24-21) to gain access to the blanking plate.

C. Remove

(1) From within the bore of the T-pipe, remove the six

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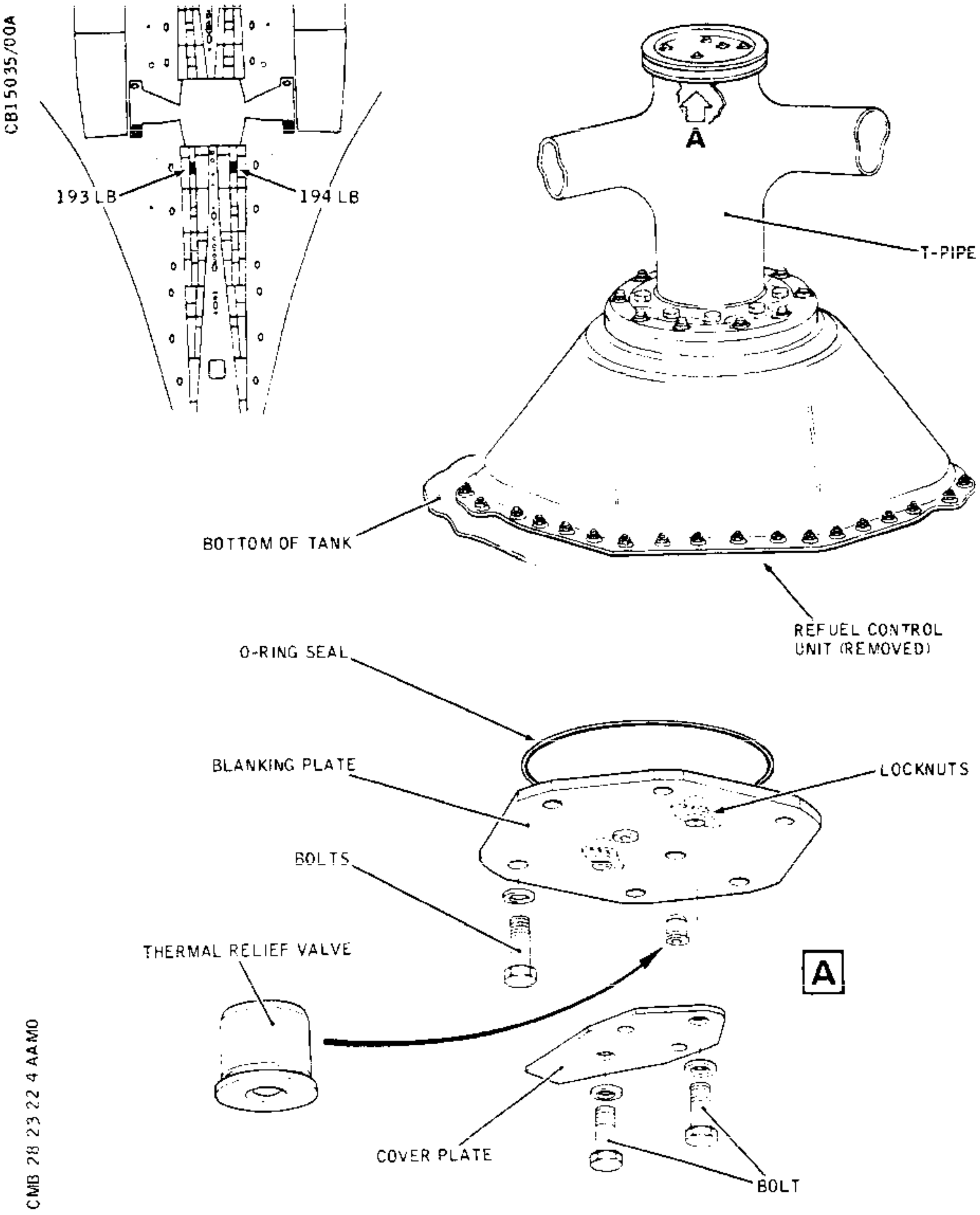

\- Thermal Relief Valve - Installation
Figure 401

bolts and washers securing the blanking plate to the top of the T-pipe; withdraw the blanking plate.

(2) Fit a suitable blank to the RCU tank mounting aperture.

(3) Remove and discard the O-ring seal from the blanking plate.

(4) Remove the two bolts and washers securing the cover plate to the blanking plate.

(5) Remove the valve(s) from the blanking plate.

NOTE: It may be necessary to use a small press to remove the valve(s).

D. Install

(1) Comply with the fuel and electrical safety precautions taken prior to removal.

(2) Clean the holes which house the valves in the blanking plate with cleaning solvent, BAC.M 302.

(3) Ensure that the valves and the holes in which they are housed are clean, dry and undamaged.

R (4) Coat the valve bodies and the holes with Viton
R sealant PR 1720SM, and allow to dry.
R
R (5) Assemble the valves in the holes; remove any excess
R sealant with cleaning solvent and ensure that the valve orifices are unobstructed.

R (6) Position the cover plate over the two valves and secure it to the blanking plate with the two bolts and washers. Torque-tighten each bolt to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

R (7) Remove the blank from the RCU tank mounting aperture.

R (8) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the blanking plate.

R (9) Place the blanking plate, O-ring seal facing upward, in position at the top of the T-pipe. Secure the plate to the T-pipe with the six bolts and washers, torque-tightening each bolt to between 71 and 80

lbf in (0.802 and 0.904 mdaN).

NOTE: An extended part of the cover plate prevents incorrect (i.e., inverted) fitting of the assembly.

E. Conclusion

(1) Install the RCU (Ref. 28-24-21).

(2) Carry out a Functional Test of the valves (Ref. Adjustment/Test).

THERMAL RELIEF VALVE - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises a Functional Test of a thermal relief valve. Operational and System Tests are not applicable.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Two 6 ft (1.83 m) lengths of transparent plastic tube	-
Two 1,000 cc containers	-
Fuel test rig, capable of delivering 65 psig (4.482 bar) pressure	-
Valve dummy element	E925117000
Blank, for thermal relief valves	E925132000

B. Prepare

(1) Defuel and drain (Ref. 28-25-00, Servicing) the appropriate tank (tank 5 - LH valves; tank 8 - RH valves).

(2) Ensure that the refuel control panel access door is closed.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the settings of the switches must not be altered.

(4) Remove a forward collector tank jettison valve (Ref. 28-31-11) and in its place fit a valve dummy element. Ensure that the valve dummy element is orientated to allow pressurization of the trim transfer pipe.

(5) Connect the fuel test rig to the adapter on the dummy element.

CAUTION: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(6) Remove the appropriate tank access panel (524 AB - tank 5; 624 AB - tank 8) in order to gain access to the valves.

(7) Enter the tank and fit the thermal relief valve blank to the refuelling T-pipe.

(8) Unscrew both blank bleeder screws to allow free flow of fuel. Fit a length of transparent plastic tube to each bleeder screw.

(9) Place a clean container at the end of each tube to measure the fuel flow.

C. Test

(1) Operate the test rig and slowly increase the fuel pressure to 55 psig (3.792 bar). Check that the fuel leakage through each valve does not exceed five drops per minute.

(2) Further increase the fuel pressure and check that the valve opens between 55 and 65 psig (3.792 and 4.482 bar), by observing a steady flow of fuel into each container.

(3) Maintain the fuel pressure at 65 psig (4.482 bar) and check, over a period of 5 min, that the quantity of fuel passed through the valves and into each container is approximately 750 cc.

D. Conclusion

(1) Release the pressure and disconnect the test rig.

(2) Remove the valve dummy element and install the collector tank jettison valve (Ref. 28-31-11).

(3) Remove the tubes, containers and the thermal relief

valve blank from the refuelling T-pipe.

(4) Refit the tank access panel and refuel the tank (Ref. 12-11-28). Check that there is no fuel leakage from the access panel joint.

(5) Remove the warning placard from the fuel management panel.

PUMP UNIT (ELECTRICAL) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Electrically operated pump units, two per cell, are installed in the centre cells of tanks 9 and 10. Each unit comprises a pump element and an isolating canister. The pump element fits into, and is bolted to, the canister, which in turn is bolted to the bottom of the tank cell. A pump element may be removed without draining the tank, but to remove a canister the tank must first be drained.

A non-return valve, a relief valve (vapour vent) and a pressure relief valve, fitted to each canister, may be removed and replaced without removing the canister.

The procedures detailed below deal separately with the removal and installation of the pump element, the canister and the canister valves.

2. Pump Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Electrical bonding tester	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 95 to 105 lbf in (1.073 to 1.186 mdaN)	-

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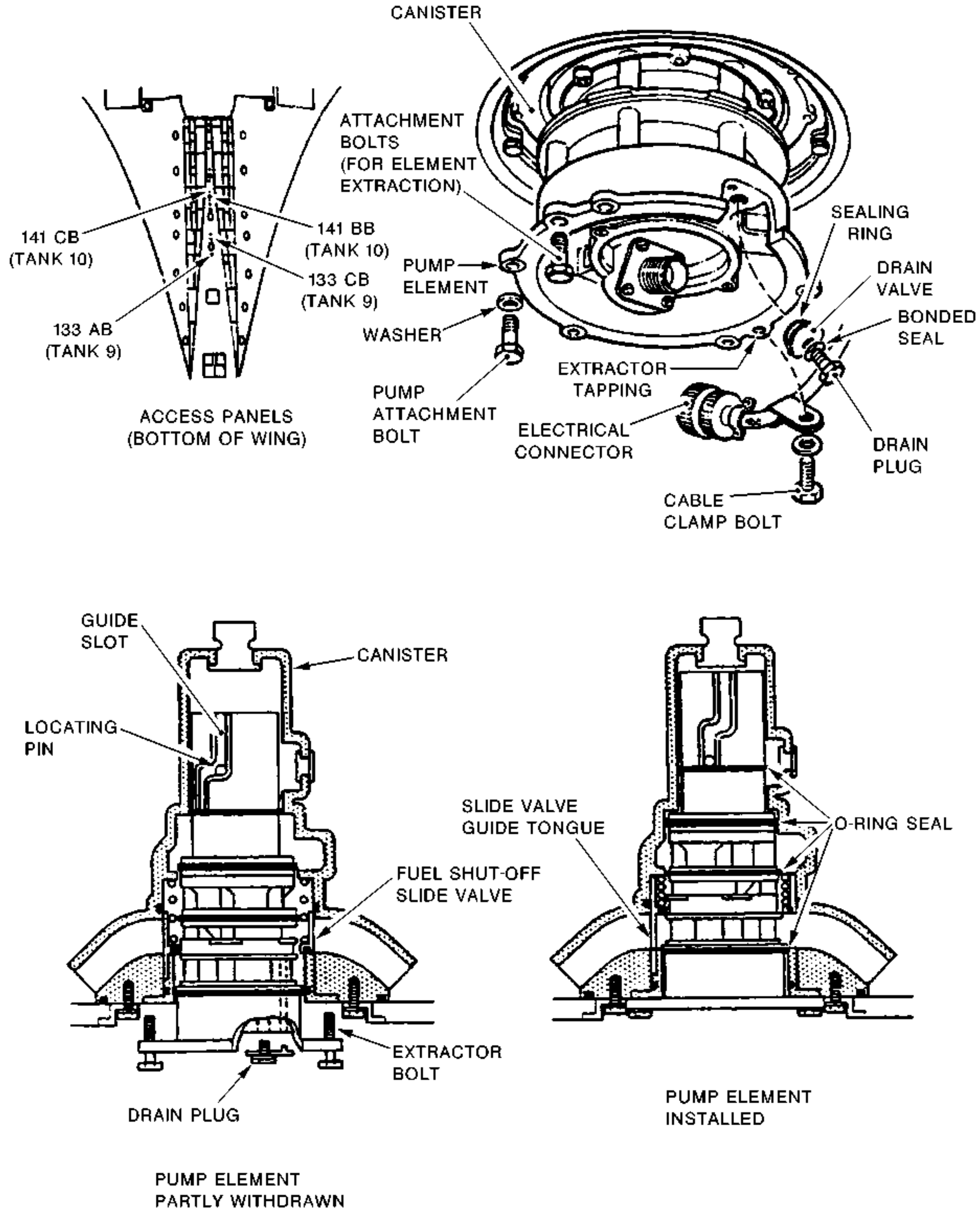

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Pump Element - Installation
Figure 401

B. Prepare to Remove Pump Element

(1) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing), and that all refuelling valve control switches on the refuelling control panel are set to SHUT. Place placards on the panels warning that the settings of the switches must not be altered.

(2) Electrically isolate the pump by tripping the associated circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP SUP (forward pump)	14-215	1Q 189	C17
TANK 9 RH PUMP SUP (rear pump)	13-216	2Q 189	B 1
TANK 10 LH PUMP SUP (forward pump)	14-216	1Q 190	B 1
TANK 10 RH PUMP SUP (rear pump)	13-215	2Q 190	C19

(3) Remove the appropriate panel (Ref. Fig.401) to gain access to the pump element.

C. Remove Pump Element

(1) Disconnect the electrical connector.

(2) Cut the locking wire and slacken off the drain plug sufficiently to facilitate its subsequent removal.

(3) Remove the six bolts and washers securing the pump element to the canister.

(4) Remove the cable clamp bolt from the extractor tapping.

(5) Remove and retain the cable clamp and bolt, and then fit two of the pump attachment bolts into the extractor tappings in the element flange.

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(6) Screw in the bolts evenly and extract the element as far as the guide slot will permit (approx. 1.25 in (32.0 mm)).

NOTE: At this stage the fuel shut-off slide valve should be seated, thus shutting off the canister ports.

(7) Position a suitable container, then remove the drain plug and plate and drain the pump element (approx. 2.0 pints (1.0 l)). If steady leakage continues after 2.0 pints (1.0 l) are drained off, check the leakage rate and if this exceeds 0.1 gal/h (Imp.) (0.45 l) renew the defective valve(s) as detailed in paragraphs 4., 5. and 6.

(8) Turn the pump element counter-clockwise until it is checked by the guide slot, then pull the pump element downward and withdraw it from the canister.

(9) From the pump element:

(a) Remove the extractor bolts.

(b) Remove and discard the four O-ring seals.

(10) Loosely refit the drain plate and plug and fit suitable blanks to the ports of the canister and pump elements.

D. Prepare to Install Pump Element

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the canister and pump element.

(3) Fit four new dry O-ring seals to the pump element body and then lubricate exposed surfaces of the seals in accordance with 20-23-11.

(4) Fit a new dry sealing ring to the drain plate. Lubricate exposed surfaces of the sealing ring in accordance with 20-23-11, then fit the drain plate to the pump element and secure it with a new bonded seal and the drain plug.

(5) If the tank is empty check that the fuel shut-off slide valve is fully extended and correctly seated.

E. Install Pump Element

NOTE: The torque-tightening values of the pump element attachment bolts require the addition of the frictional resistance.

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(1) Using a torque spanner, measure and record the torque load required to screw each bolt through its mating thread. Check that this torque load (i.e., frictional resistance) is within the limits of 3.5 to 30 lbf in (0.040 to 0.339 mdaN).

CAUTION: THE SLIDE VALVE MUST NOT BE OPERATED WHEN DRY. SPRAY FUEL BETWEEN THE SLIDE VALVE AND THE CANISTER BEFORE INSERTING THE PUMP ELEMENT.

(2) Insert the pump element into the canister and engage the guide pin in the pump element guide slot.

(3) Carefully slide the pump element in until the guide pin abuts the stop of the guide slot. The pump element will then be approximately 1.25 in (32 mm) from the fully inserted position.

CAUTION: THE FOLLOWING OPERATION WILL LIFT THE SLIDE VALVE AND OPEN THE FUEL PORTS. DO NOT FORCE THE PUMP ELEMENT OR DAMAGE TO THE SLIDE VALVE MAY RESULT.

DO NOT USE THE ATTACHMENT BOLTS TO ASSIST THE PUMP ELEMENT INTO POSITION.

(4) Turn the pump element clockwise to align the attachment holes, and then, using hand pressure only, push it fully in.

(5) Holding the element in position, secure it with the six bolts and washers. Progressively tighten the bolts evenly, in a diametrically opposite sequence, and then torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN), plus the frictional resistance.

(6) Torque-tighten the drain plug to between 95 and 105 lbf in (1.073 and 1.186 mdaN) and wire-lock the plug in accordance with 20-21-13.

(7) Connect the electrical connector to the pump element, ensuring that the mating surfaces are clean and undamaged.

CAUTION: USE THE CORRECT BOLT TO SECURE THE CABLE CLAMP TO THE EXTRACTOR TAPPING. IF THE BOLT IS TOO LONG, IT MAY CRACK THE PUMP CASTING.

(8) Connect the clamp to the cable and secure it with the bolt to the extractor tapping in the element.

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(9) Using a safety bonding tester, check that the electrical resistance between the pump element and the canister is not greater than 0.01 ohm.

F. Conclusion

(1) Remove the safety clip and reset the circuit breaker tripped before removal.

(2) Remove the warning placard from the fuel management panel.

(3) Carry out a Functional Test of the pump element (Ref. Adjustment/Test).

(4) Refit the access panel and torque-tighten the securing bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

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3. Canister (Ref. Figs.402, 403 and 404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 50 to 60 lbf in (0.565 to 0.678 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 80 to 90 lbf in (0.904 to 1.017 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-

DESCRIPTION	PART NO.
Viton rubber (Ref. 20-30-00, No.200), for filter collar/tank seal	-
Electrical bonding tester	-
Suitable suction equipment, to collect spilled fuel	-
After SB 28-018 For A/C 001-005,	
Sealant, PR 1720R (Ref. 20-30-00, No.390)	-
Sealant PT 1720SM (Ref. 20-30-00, No. 351)	-

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B. Prepare to Remove Canister

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Drain the residual fuel in the pipes by operating the TRIM PIPE DRAIN valves switch on the fuel management panel.

(3) Remove the pump element (Ref. para.2.).

C. Remove Canister

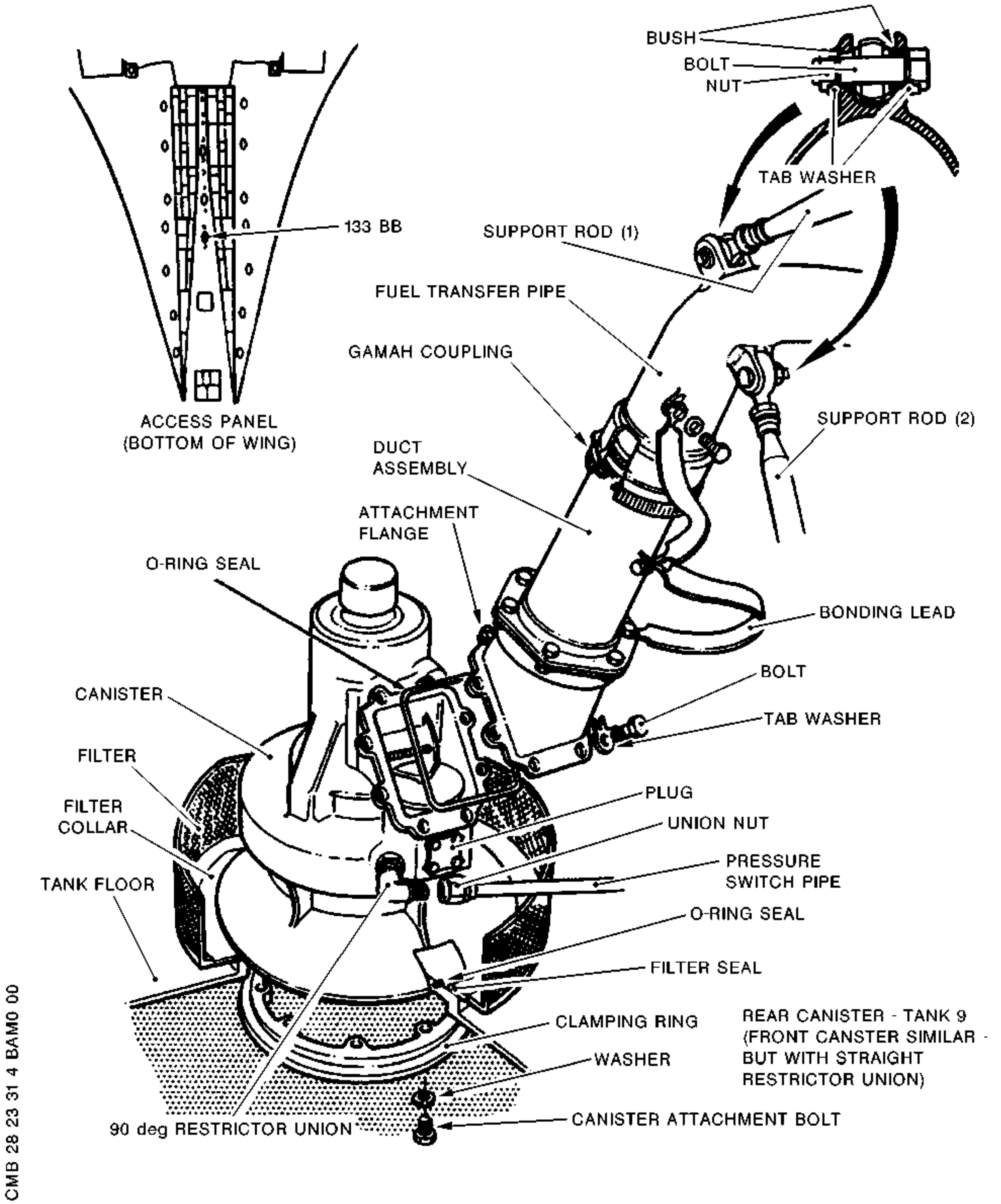
WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

(1) Remove the appropriate tank panel (Ref. Fig.402) (Ref. Fig.403) to gain access to the canister.

NOTE: Two probe units are attached to the access panel to tank 9 and these must be removed (Ref. 28-44-51) before the tank panel is removed.

(2) Unscrew the union nuts at each end of the pressure switch pipe. Disconnect the pipe clip, noting the attachment location of the bonding lead, and then remove the pipe.

(3) Disconnect the bonding leads to allow removal of the fuel transfer pipe (tank 10) or the duct assembly (tank 9). Note the attachment locations of the leads for subsequent installation.



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Canister (Tank 9) - Installation
Figure 402

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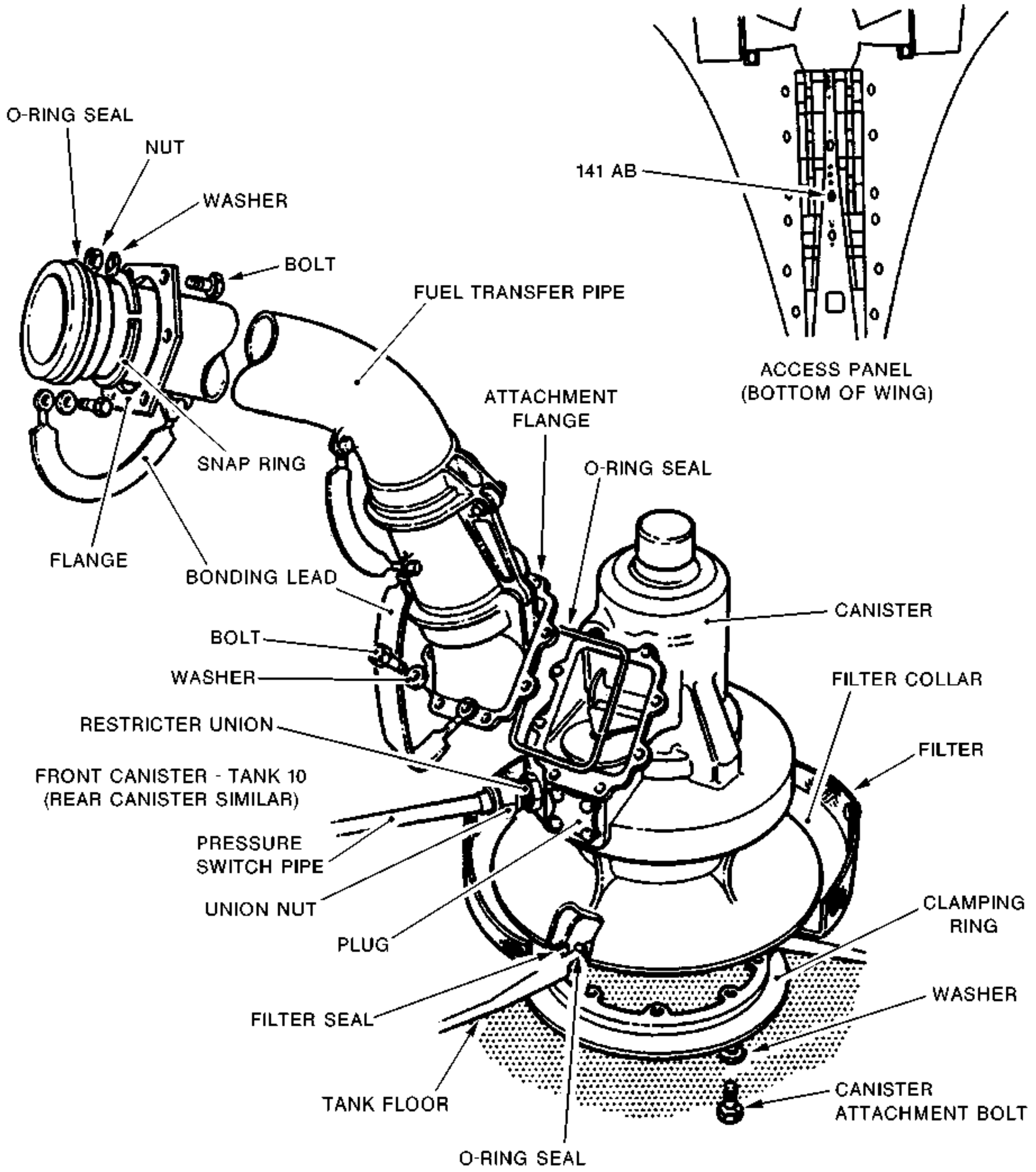

Canister (Tank 10) - Installation
Figure 403

(4) Slacken the bolts securing the attachment flange of the fuel transfer pipe (tank 10), or the duct assembly (tank 9) to the canister. Be prepared to collect, preferably using suitable suction equipment, any residual fuel that may drain from the pipe through the flange joint. After draining is completed, remove the bolts and washers, noting the position of the special bonding bolt for subsequent installation.

(5) On tank 9 (Ref. Fig.402):

(a) Disconnect the Gamah coupling (Ref. 20-23-21) securing the duct assembly to the fuel transfer pipe. Remove the duct assembly.

NOTE: It may be necessary to disconnect the adjustable support rods, by removing the nut, bolt, tabwashers and bushes, in order to displace the fuel transfer pipe sufficiently to remove the duct assembly.

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(6) On tank 10 (Ref. Fig.403):

(a) At the other end of the fuel transfer pipe, remove the bolts, washers and nuts at the flanged joint and withdraw the fuel transfer pipe. Note the position of the bonding bolt.

(7) Remove and discard the O-ring seals from the fuel transfer pipe or the duct assembly, as appropriate.

(8) From outside the tank, unscrew the attachment bolts and washers, noting the position of the bonding bolt, and remove the clamping ring.

(9) From inside the tank, remove the canister. Discard the O-ring seal from the groove in the canister flange.

(10) Remove the filter assembly. Remove and discard the filter collar seal.

(11) If a new canister is to be fitted:

(a) Remove from the canister and retain the pressure switch pipe restrictor union. Remove and discard the union O-ring seal.

(b) Remove the plug (Ref. Fig.404) and remove and discard the plug O-ring seal.

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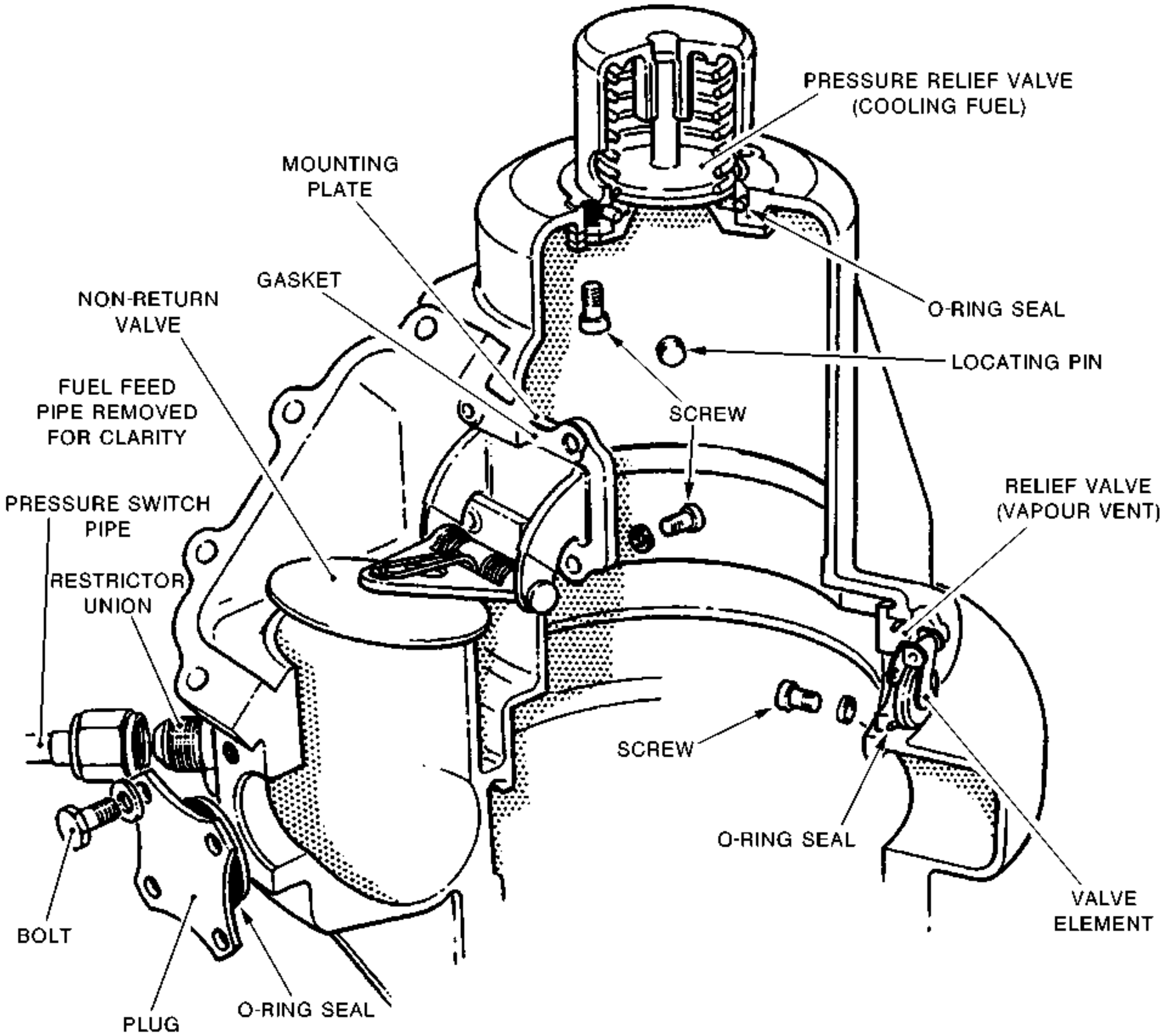

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Canister Valves - Installation
Figure 404

(12) Fit suitable blanks to exposed ports and apertures.

D. Prepare to Install Canister

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the ports and apertures.

(3) Ensure that all joint faces are clean and free from corrosion.

(4) If a new canister is to be fitted:

(a) Fit the original pressure switch pipe restrictor union, together with a new O-ring seal, to the replacement canister. Lubricate the seal in accordance with 20-23-11. Torque-tighten a straight restrictor union to between 107 and 117 lbf in (1.209 and 1.322 mdaN). For the rear canister in tank 9, loosely fit the 90 deg restrictor union and O-ring seal as detailed in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'.

(b) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the original plug. Fit the plug to the replacement canister, using the four bolts and washers. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 to 0.621 mdaN).

(5) Make a new filter seal, using a length of specially profiled Viton rubber, join the scarfed ends by bonding with Viton sealant PR 1720, in accordance with 20-22-21.

E. Install Canister

Before SB 28-018

(1) Insert the new seal, lubricated in accordance with 20-23-11, in the groove of the filter collar.

After SB 28-018 For A/C 001-005,

(1) Insert the new, dry, seal in the groove of the filter collar and apply Viton sealant to the mating surfaces of the tank and the filter collar, using either of the following sealants:

(a) PR 1720R (prefabricated tape): re-activate the Viton using cyclohexanone during application.

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(b) PR 1720SM (semi-paste/fluid): applied by brush or spatula in accordance with 20-22-21, where tape cannot be applied.

(2) Inside the tank, install the pump filter assembly.

Before SB 28-018

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the annular groove in the canister flange face.

After SB 28-018 For A/C 001-005,

(3) Fit a new, dry, O-ring seal to the annular groove in the canister flange face and apply Viton sealant to the mating surfaces of the tank and the canister, using either of the sealants described in paragraph (1).

(4) Inside the tank, position the canister on its mounting, aligning the outlet with the fuel transfer pipe. Outside the tank, place the clamping ring in position and then fit the attachment bolts and washers, ensuring that the bonding bolt is correctly positioned. Do not tighten the bolts at this stage.

(5) For the rear canister in tank 9, complete the installation of the 90 deg restrictor union as detailed in 28-22-12, Figure 403, 'Sensing Pipe - Adapter Installation'. Torque-tighten the restrictor union nuts to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(6) Connect one end of the pressure switch pipe to the restrictor union and the other end to the tank union. Torque-tighten the pipe union nuts to between 40 and 65 lbf in (0.452 and 0.734 mdaN). Secure the pipe clip and bonding lead in the position noted during removal.

(7) Ensure that the canister is positioned concentrically on its mounting and then tighten the attachment bolts, evenly, in a diametrically opposite sequence. Finally, torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

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(8) Tank 9 (Ref. Fig.402):

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the duct assembly attachment flange. At the other end of the duct assembly, fit the Gamah coupling components (Ref. 20-23-21).

(b) Position the duct assembly and secure the attachment flange to the canister with the eight bolts and new tabwashers. Ensure that the bonding bolt is correctly positioned. Torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN) and lock them with the tabwashers in accordance with 20-21-17.

(c) Secure the Gamah coupling in accordance with 20-23-21.

(d) Reconnect the bonding lead.

(e) If the adjustable support rods were disconnected, connect and secure them with the bolts, bushes, new tabwashers and nuts. Torque-tighten the nut securing support rod (1) to between 80 and 90 lbf in (0.904 and 1.017 mdaN), and the nut securing support rod (2) to between 50 and 60 lbf in (0.565 and 0.678 mdaN). Lock the nuts with tabwashers in accordance with 20-21-17.

(9) Tank 10 (Ref. Fig.403).

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the fuel transfer pipe attachment flange. At the other end of the transfer pipe, ensure that the snap ring and flanged joint are positioned and fit a new O-ring seal, lubricated in accordance with 20-23-11.

(b) Position the transfer pipe and secure the attachment flange to the canister with the eight bolts and washers, ensuring that the bonding bolt and bonding lead are correctly positioned. Torque-tighten the bolts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(c) Secure the flanged joint with the six bolts, nuts and washers, ensuring that the bonding bolt is correctly positioned. Torque-tighten the nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

(d) Reconnect the bonding lead.

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(10) Check that the electrical bonding between the pipes, canister, filter collar and tank structure is in accordance with 20-27-11.

(11) Manually operate the canister relief valve (vapour vent) and check that it moves freely and closes correctly when released.

(12) Ensure that the fuel shut-off slide valve is fully down, otherwise the element will not enter.

F. Conclusion

(1) Carry out a Leakage Test of the duct assembly (tank 9) or transfer pipe (tank 10) joints (Ref. Adjustment/Test).

R (2) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken,
R frayed, or with braid loose in the crimp is to be
R replaced before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (3) Refit the tank access panel and torque-tighten the securing bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

R (4) Tank 9: Refit the probes (Ref. 28-44-51).

R (5) Using a safety bonding tester, check that the electrical resistance between the panel and the associated structure does not exceed 10 milliohm.

R (6) Refuel the tank (Ref. 12-11-28) and check the tank access panel and, if applicable, probe access panels, for freedom from leakage.

R (7) Carry out a Leakage Test of the canister valves and an Operational Test and a Functional Test of the canister pressure relief valve (Ref. Adjustment/Test).

R (8) Install the pump element (Ref. para.2.)

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4. Canister Non-return Valve (Ref. Fig.404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Hexagonal key, 0.14 in (3.5 mm)	-
Right-angled Troquemaster wrench	558-4-03288
Sealant, PR 1005L (Ref. 20-30-00, No.372)	-
Loctite, Grade A Specification 1000/P/8	-

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B. Prepare to Remove Canister Non-return Valve

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Drain the residual fuel in the pipes by operating the TRIM PIPE DRAIN valves switch on the fuel management panel.

(3) Remove the pump element (Ref. para.2.).

C. Remove Canister Non-return Valve

(1) From within the canister, using a suitable hexagonal key, remove the four screws and washers and withdraw the valve assembly and gasket from the inside of the canister.

NOTE: When the upper two screws are removed the valve assembly will be canted by the load of the valve spring.

(2) Remove and discard the gasket from the mounting plate.

D. Install Canister Non-return Valve

NOTE: Ensure that all passages are free from obstruction and that all joint faces are clean, dry and undamaged.

(1) Ensure that the gasket groove in the mounting plate is clean and degreased.

(2) Lightly coat one side of a new gasket with sealing compound PR 1005L (DTD/900/4493), then allow it to stand for approximately 20 min until the sealant is tack-free.

(3) Fix the gasket to the mounting plate with the sealing compound abutting the groove in the mounting plate.

(4) Insert the valve assembly into the canister, with the valve flap uppermost, then secure it with the four washers and screws, treated with Loctite Grade A, Specification No. 1000/P/8.

(5) Evenly tighten the screws, ensuring, before fully tight, that the mounting plate spigot has entered the outlet duct. Using the right-angled wrench, torque-tighten the screws to between 9 and 11 lbf in (0.10 and 0.12 mdaN).

E. Conclusion

(1) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

(2) Refuel the tank (Ref. 12-11-28) and check for freedom from fuel leaks around the valve and the mounting plate.

(3) Install the pump element (Ref. para.2.).

5. Canister Relief Valve (Vapour Vent) (Ref. Fig.404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Hexagonal key, 0.14 in (3.5 mm)	-
Right-angled Torquemaster wrench	558-4-03288

B. Prepare to Remove Canister Relief Valve (Vapour Vent)

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Drain the residual fuel in the pipes by operating the TRIM PIPE DRAIN valves switch on the fuel management panel.

(3) Remove the pump element (Ref. para.2.).

C. Remove Canister Relief Valve (Vapour Vent)

(1) From within the canister, using a suitable hexagonal key, remove the two screws and washers and withdraw the valve element and the mounting assembly.

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(2) Remove the two screws and washers from the mounting assembly and remove the valve element from the mounting assembly.

(3) Remove and discard the O-ring seal from the mounting assembly.

D. Install Canister Relief Valve (Vapour Vent)

(1) Ensure that all passages are free from obstruction and that all joint faces are clean, dry and undamaged.

CAUTION: UNEVEN TIGHTENING OF SCREWS CAN DISTORT THE MOUNTING ASSEMBLY AND CAUSE MALFUNCTIONING.

(2) Fit the valve element to the mounting assembly and secure it with the two washers and screws. Evenly torque-tighten the screws to between 3 and 5 lbf in (0.03 and 0.05 mdaN).

(3) Check that the valve flap opens, then returns and seats correctly when released.

(4) Fit a new O-ring seal, lubricated with fuel, to the mounting assembly.

(5) Fit the complete assembly, valve flap leading, into the canister sidewall and secure it with two washers and screws. Using the right-angled wrench, torque-tighten the screws evenly to between 9 and 11 lbf in (0.10 and 0.12 mdaN).

E. Conclusion

(1) Carry out a Functional Test of the valve (Ref. Adjustment/Test).

(2) Refuel the tank (Ref. 12-11-28) and check for freedom from fuel leaks around the valve and the mounting plate.

(3) Install the pump element (Ref. para.2.).

6. Canister Pressure Relief Valve (Ref. Fig.404)

A. Equipment and Materials

DESCRIPTION	PART NO.
Hexagonal key, 0.14 in (3.5 mm)	-
Torque screwdriver	-

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B. Prepare to Remove Canister Pressure Relief Valve

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Drain residual fuel in the pipes by operating the TRIM PIPE DRAIN valves switch on the fuel management panel.

(3) Remove the pump element (Ref. para.2.).

C. Remove Canister Pressure Relief Valve

(1) From within the canister, using a suitable hexagonal key, remove the two screws and then withdraw the assembly.

(2) Remove and discard the O-ring seal.

D. Install Canister Pressure Relief Valve

(1) Fit a new O-ring seal, lubricated with fuel, to the groove in the valve housing.

(2) Secure the valve with the two screws. Tighten the screws evenly, using the torque screwdriver, to between 9 and 11 lbf in (0.10 and 0.12 mdaN).

E. Conclusion

(1) Carry out an Operational Test and a Functional Test of the valve (Ref. Adjustment/Test).

(2) Refuel the tank (Ref. 12-11-28) and check for freedom from fuel leaks around the valve and the mounting plate.

(3) Install the pump element (Ref. para.2.).

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PUMP UNITS (TANKS 9 AND 10) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

R This topic comprises Functional Tests of the pump element and the isolation canister. It also details Operational and Functional Tests of the canister pressure relief valve. A System Test is not applicable.

R The forward pumps in each centre cell of tanks 9 and 10 are associated with the left-hand trim system and the rear pumps are associated with the right-hand trim system.

R Controls and indicators required for the test are on the fuel management panel at the third crew member's station. Each pump has a separate 3-position control switch marked ON, AUTO and OFF.

2. Functional Test - Pump Element

A. Prepare to Test Pump Element

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Refuel to high level (Ref. 12-11-28) the tank containing the pump element.

(4) Ensure that tank 5 (for the LH system) or tank 7 (for the RH system) has the capacity to receive at least 3,000 kg of fuel for the test. Defuel if necessary (Ref. 28-25-00, Servicing).

(5) Open the pump element access panel (Ref. Removal/Installation).

B. Test Pump Element

(1) Check, during a period of 15 min, that there is no external leakage of fuel from the element-to-canister and canister-to-tank joints.

(2) Set the appropriate tank 7 or tank 5 INLET VALVE MAIN switch to "OPEN" and check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes, and then to bar-in-line.

(3) Set the PUMP switch for the pump under test to "ON" and check that the LOW PRESS caption is illuminated, and then extinguished after 3 s, indicating the correct build-up of pump pressure.

(4) Observe the associated fuel quantity indicator and check, for a minimum duration of 3 min, that the fuel transfer flow rate is not less than 700 kg/min when transferring into tank 5 and not less than 636 kg/min when transferring into tank 7.

(5) Set the PUMP switch to "OFF".

(6) Set the INLET VALVE MAIN switch to "SHUT".

C. Conclusion

R (1) Refit the access panel and torque-tighten the securing
R bolts to between 71 and 80 lbf in (0.802 and
R 0.904 mdaN).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test - Isolation Canister

A. Prepare to Test Isolation Canister

(1) Defuel and drain (Ref. 28-25-00, Servicing) the tank containing the canister.

(2) Ensure that the adjoining tank (9 or 10) contains fuel. Refuel as necessary (Ref. 12-11-28).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(3) Drain the trim transfer pipe as follows:-

(a) Position a container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the

JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(f) Remove the container.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel access door is closed. Place placards near both panels warning that the settings of the switches must not be altered.

(5) Remove the pump element (Ref. Removal/Installation).

(6) Remove the tank access panel (Ref. Removal/ Installation) to gain access to the canister.

B. Test Isolation Canister

(1) From within the bore of the canister, manually
R operate the vapour vent flap valve mounted in the
R side of the canister; check that the valve moves
R freely and seats correctly when released.

R (2) Position a suitable container to collect fuel that will leak from the canister when the trim system is pressurized and when the tank is refuelled.

R (3) At the fuel management panel, pressurize the appropriate trim system (LH or RH) with fuel, as follows:-

(a) Check that all inlet valve magnetic indicators display bar-across-line.

(b) To test a canister in tank 9, set the appropriate (LH or RH) tank 10 PUMP switch to "ON".

(c) To test a canister in tank 10, set the appropriate (LH or RH) tank 9 PUMP switch to "ON".

(d) Set the appropriate INLET VALVES MAIN switch (tank 5 for the LH system, or tank 7 for the RH system) to "OPEN" for 1 min to bleed the system of air.

(e) Set the INLET VALVES MAIN switch to "SHUT".

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

R (4) Enter the tank and check, for a minimum period of
15 min, that there is no fuel leakage from the
R transfer pipe joints at the canister outlet.

R (5) Set the PUMP switch to "OFF".

R (6) Refit the tank access panel and torque-tighten the
R securing bolts to between 71 and 80 lbf in (0.802
R and 0.904 mdaN).

R (7) Using a safety ohmmeter, check that the electrical
R resistance between the panel and the adjoining
R structure does not exceed 10 milliohm.

(8) Refuel the tank (Ref. 12-11-28) to high level capacity.

R (9) Check that the total fuel leakage from all the
R canister valves does not exceed 0.1 gal/h (Imp.)
R (0.45 l/h).

(10) Check that there is no fuel leakage from the tank access panel joint.

C. Conclusion

(1) Install the pump element (Ref. Removal/Installation).

(2) Carry out a Functional Test of the pump element (Ref. para.2.).

R 4. Operational Test - Pressure Relief Valve

R NOTE: The purpose of this test is to check that the pressure
R relief valve has not failed in the closed position.

R A. Prepare to Test Pressure Relief Valve

R (1) Ensure that the tank contains fuel. Refuel as necessary (Ref. 12-11-28).

R (2) Make available electrical ground power as detailed in 24-41-00.

R B. Test Pressure Relief Valve

R (1) At the fuel management panel, pressurize the appropriate trim system (LH or RH) with fuel, as follows:-

R (a) Check that all inlet valve magnetic indicators display bar-across-line.

R (b) Set the PUMP switch, associated with the canister pressure relief valve, to "ON".

R (c) Set the appropriate INLET VALVES MAIN switch (tank 5 for the LH system or tank 7 for the RH system) to "OPEN" for 1 min to bleed the system of air.

R (d) Set the INLET VALVES MAIN switch to "SHUT".

R (2) Check, during a 2 min test period, that the pump circuit breaker (Ref. Removal/Installation) does not trip.

R NOTE: If the pressure relief valve has failed in the closed position, the resultant low flow condition in the pump will create a demand for excessive electrical current, causing the circuit breaker to trip.

R (3) Set the PUMP switch to "OFF".

R (4) If, during operation (2), the pump circuit breaker tripped, renew the pressure relief valve (Ref. Removal/Installation, para.6.).

R C. Conclusion

R (1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 5. Functional Test - Pressure Relief Valve

R NOTE: The purpose of this test is to check that the pressure relief valve has not failed in the open position.

R A. Prepare to Test Pressure Relief Valve

R (1) Refuel the tank (Ref. 12-11-28).

R (2) Drain the trim transfer pipe as detailed in paragraph 3.A.(3).

R B. Test Pressure Relief Valve

R (1) Withdraw the pump element as far as the guide slot will permit (approx. 1.25 in (32.0 mm)) (Ref. Removal/Installation).

R (2) Position a suitable container to collect spilled fuel, and then move the drain plate clear of the drain hole to drain the pump element (approx. 2 pints (Imp.) (1.14 l)).

R (3) If steady leakage, in excess of 0.1 gal/h (Imp.) (0.45 l/h), continues after operation (2), renew the pressure relief valve (Ref. Removal/Installation, para.6.).

R NOTE: Excessive steady leakage indicates that the pressure relief valve has failed in the open position.

R C. Conclusion

R (1) Install the pump element (Ref. Removal/Installation).

PUMP PRESSURE SWITCH (TANKS 9 AND 10) - REMOVAL/INSTALLATION

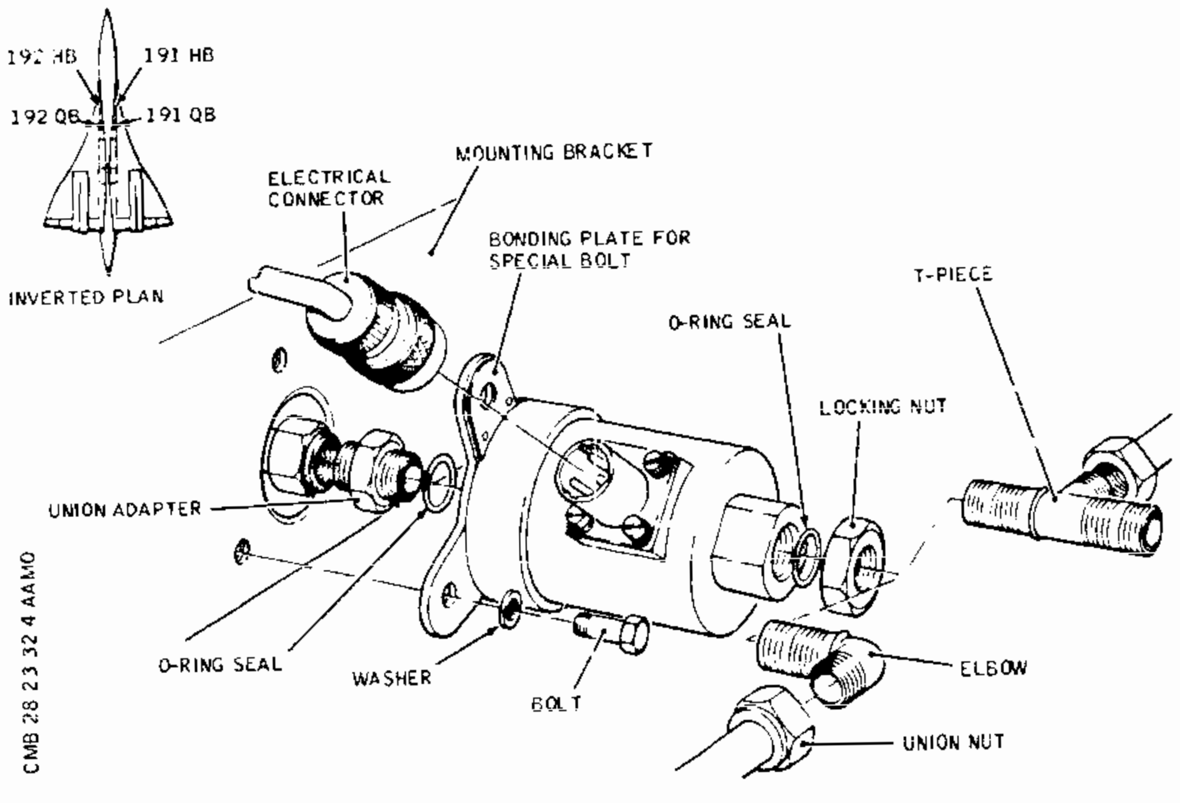
WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

A pressure switch is connected to the pump outlet of each fuel transfer pump in centre tanks 9 and 10. The switch senses low pressure output from the pump and gives warning of this by illuminating a warning caption on the fuel system management panel in the flight compartment.

2. Pressure Switch (Ref. Fig. 401)



\- Pressure Switch - Installation
Figure 401

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 40 to 45 lbf in (0.45 to 0.51 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN)	-

B. Prepare

(1) Ensure that all the fuel management panel switches are in their usual ground positions and all refuelling valve control switches are set to SHUT. Place placards on the panels warning that the position of the switches must not be changed.

(2) Defuel the associated fuel tank (Ref. 28-25-00).

(3) Electrically isolate the appropriate pump supply, control and indication circuits by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 9 LH PUMP SUP	14-215	1Q189	C17
TANK 9 RH PUMP SUP	13-216	2Q189	B1
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 RH PUMP CONT	13-215	2Q184	B16
TANK 10 LH PUMP SUP	14-216	1Q190	B1
TANK 10 RH PUMP SUP	13-215	2Q190	C19
TANK 9 LH & 10 RH PUMPS IND	15-215	Q182	D21

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 RH & 10 LH PUMPS IND	15-216	Q183	D1

(4) Gain access to the pressure switch by removing the appropriate access panel (Ref. Table 401).

SERVICE	ACCESS PANEL
Tank 9	
Forward pump pressure switch	191 HB
Aft pump pressure switch	192 HB
Tank 10	
Forward pump pressure switch	191 QB
Aft pump pressure switch	192 QB

Pressure Switch Access Panels
Table 401

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the fuel pipes from the pressure switch by unscrewing the union nuts.

(3) Remove the attachment bolts and washers and withdraw the pressure switch. Identify and note the position of the special bonding bolt. If a replacement pressure switch is to be fitted, remove the union adapter and/or elbow (or T-piece) for transfer to the new pressure switch.

(4) Fit suitable blanks to the pressure switch ports

and the open pipe ends.

D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the pipe ends and pressure switch.

(3) If a replacement pressure switch is to be fitted, assemble new O-ring seals, lubricated with fuel, to the union adapter and elbow (or T-piece). Fit the union adapter and elbow (or T-piece) to the switch and screw them in finger-tight only.

(4) Position and secure the pressure switch with the attachment bolts and washers. The special bonding bolt must be placed in the position previously noted. Torque-tighten the bolts to between 40 and 45 lbf in (0.45 and 0.51 mdaN).

(5) Line up the elbow (or T-piece) with the associated fuel pipe or pipes then torque-tighten the locking nut to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(6) Torque-tighten the union adapter to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(7) Check that the pressure switch is electrically bonded in accordance with 20-27-11.

(8) Connect the fuel pipes. Torque-tighten the union nuts to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(9) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

(10) Refuel the tank (Ref. 12-11-28) and check for fuel leakage at the union adapter, the union nuts and the elbow (or T-piece).

E. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal and remove the warning placards.

(2) Carry out an Operational Test of the pressure switch (Ref. Adjustment/Test).

(3) Fit the panel removed to gain access to the pressure switch.

PUMP PRESSURE SWITCH (TANKS 9 AND 10) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Low pressure output from each of the pumps in tank 9 and tank 10 is sensed by an associated pressure switch that controls the illumination of a warning caption near the PUMP switch on the fuel management panel.

Each pressure switch is mounted outside the tank, on the adjoining structure close to its associated pump. Access to the switches is gained by removing panels in the underwing fairing. This topic comprises a Functional Test; Operational and System Tests are not applicable.

2. Functional Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Refuel the associated tank (Ref. 12-11-28) to high level capacity.

(3) Make available electrical ground power as detailed in 24-41-00.

(4) Remove the appropriate access panel (Ref. Removal/Installation).

B. Test

(1) On the fuel management panel, set the associated PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated, and then extinguished within 3 s, indicating that the pump is operating.

(2) Trip the associated pump control circuit breaker and check that the LOW PRESS caption is illuminated, thereby indicating pressure failure sensed by the pressure switch.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 RH PUMP CONT	13-215	2Q184	B16

(3) Reset the circuit breaker tripped in operation (2) and, with the pump operating, check the pressure switch and adjoining pipes for freedom from fuel leakage during a minimum period of 5 min.

(4) Set the PUMP switch to "AUTO".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Refit the access panel.

HYDRAULIC SELECTOR VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE HYDRAULIC SAFETY PRECAUTIONS DETAILED IN 29-00-00.

1. General

Two selector valves, one per pump, control the two hydraulically operated fuel pumps in tank 11. The valves act as two-position on/off selectors and are mounted on the LH (green) and RH (blue) hydraulic system manifolds in the fuselage belly.

Each selector valve is electrically operated through an integral solenoid and is independently controlled by a switch on the fuel management panel in the flight compartment.

2. Hydraulic Selector Valve (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 55 - 66 lbf in (0.62 - 0.75 mdaN)	-
Locking wire	-

B. Prepare

(1) Depressurize the appropriate hydraulic system (Ref. 29-00-00).

(2) On the fuel management panel set the associated pump switch to "OFF".

(3) Electrically isolate the pump control and indication circuits by tripping the appropriate circuit breakers; fit safety clips.

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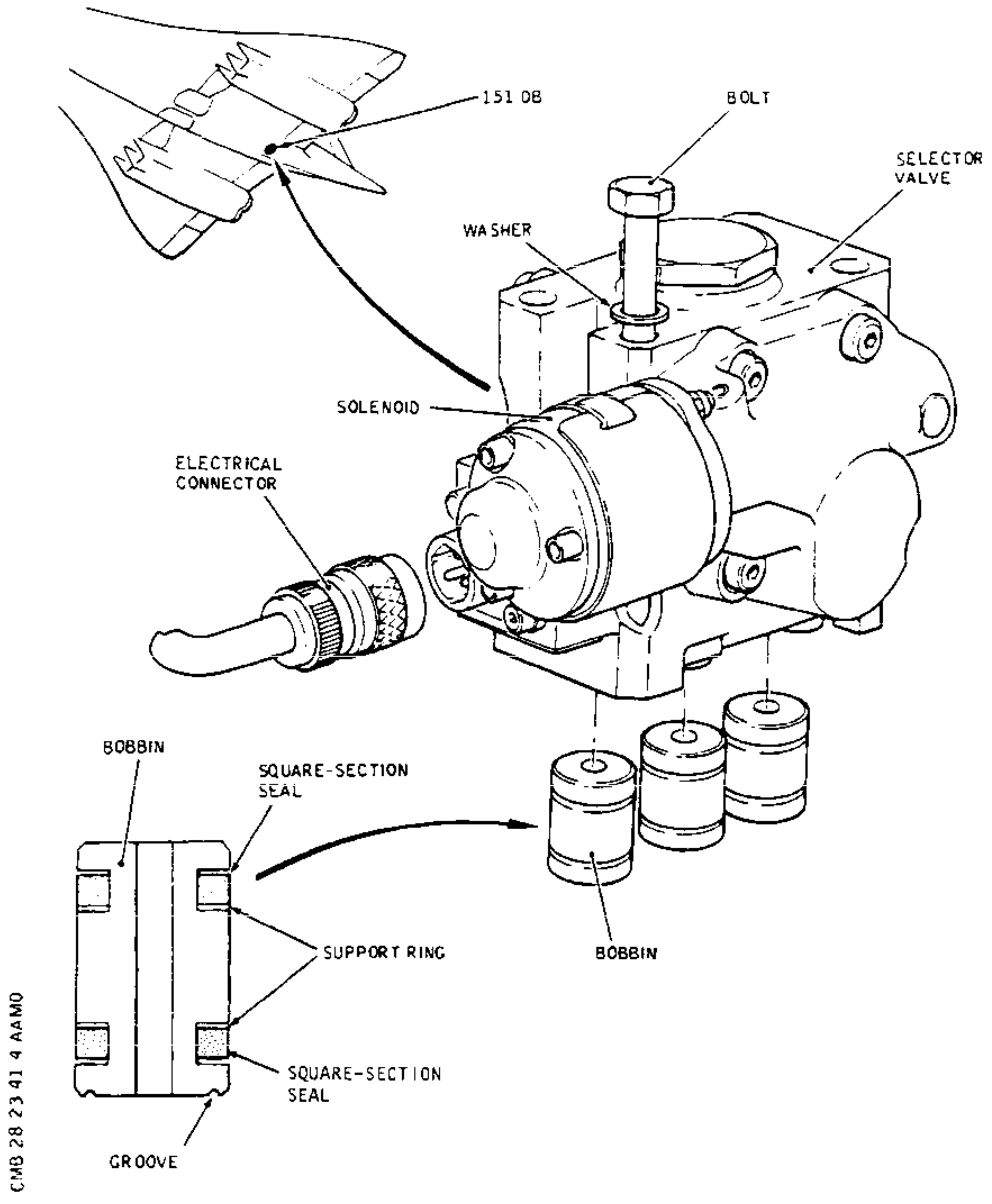

Hydraulic Selector Valve - Installation
Figure 401

R

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 GRN PUMP CONT	1-213	1Q185	J18
TANK 11 GRN PUMP IND	15-216	1Q186	D2
TANK 11 BLUE PUMP CONT	3-213	2Q185	F5
TANK 11 BLUE PUMP IND	15-215	2Q186	D22

(4) Remove panel 151 DB in the fuselage belly to gain access to the selector valve.

C. Remove

(1) Disconnect the electrical connector from the selector valve and tape it clear of possible contamination by hydraulic fluid.

(2) Position a suitable container to collect spilled hydraulic fluid when the valve is removed.

(3) Remove the locking wire from the attachment bolts and remove the bolts and washers attaching the selector valve to the manifold and withdraw the valve.

NOTE: Three bobbins interconnect the selector valve and the manifold head.

(4) Fit suitable blanks to the exposed ports of the valve and the manifold.

(5) Retain the bobbins for reassembly.

(6) Clean up any spilled hydraulic fluid.

D. Install

(1) Observe the hydraulic and electrical safety precautions.

(2) Remove the blanks from the selector valve ports and remove and discard the bobbin seals.

(3) Clean the bobbins, then fit new bobbin seals in

R accordance with 20-22-16.

R NOTE: The grooved ends of the bobbins are fitted
R into the manifold.
R

(4) Remove the blanks from the manifold ports. Ensure that the ports are clean and lightly lubricated with hydraulic fluid Oronite M2V.

(5) Position and secure that valve to the manifold with the bolts and washers. Ensure that the O-rings are not damaged during assembly, and that the countersunk sides of the washers are against the underside of the bolt heads. Torque-tighten the bolts to between 55 and 66 lbf in (0.62 and 0.75 mdaN) and wire-lock them in pairs in accordance with 20-21-13.

(6) Connect the electrical connector to the selector valve, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the container used for collecting hydraulic fluid. Clean up any spilled fluid.

(2) Remove the safety clips and set the circuit breakers tripped before removal.

(3) Carry out a Functional Test of the selector valve (Ref.Adjustment/Test), and check the valve/manifold joint for leaks.

(4) Fit the panel removed to gain access to the selector valve.

HYDRAULIC SELECTOR VALVE - ADJUSTMENT/TEST

1. General

Each selector valve is controlled by a switch on the fuel management panel in the flight compartment. The Functional Test detailed below verifies the correct operation of the selector valve. Operational and System Tests are not considered necessary in this application.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Hydraulic supply rig	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Connect the hydraulic supply rig to the ground connector of the hydraulic system (green or blue) of the selector valve to be tested (Ref. Chap.29).

C. Test

WARNING: OBSERVE THE FUEL LOAD DISTRIBUTION LIMITATIONS (REF. 28-25-00, SERVICING) WHEN REFUELLING, DEFUELLING OR TRANSFERRING FUEL.

(1) Operate the hydraulic supply rig and pressurize the system to 4,000 psig (272 bar).

(2) On the fuel management panel set the appropriate pump switch to "ON" and check that the associated LOW PRESS caption is illuminated and then extinguished within 3 s, indicating that the pump (and consequently the selector valve) is operating.

(3) Set the pump switch to "OFF".

D. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Disconnect the hydraulic supply rig (Ref. Chap.29).

PUMP UNIT (HYDRAULIC) TANK 11 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE HYDRAULIC SAFETY PRECAUTIONS DETAILED IN 29-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two hydraulically driven fuel pump units are fitted in the forward wall of tank 11. Each pump unit comprises a canister bolted to the tank wall, a pump element bolted to the canister and a hydraulic motor which is bolted to the pump element.

The hydraulic motor and the pump element may be removed without draining the tank but to remove the canister the tank must first be drained. The removal/installation procedures detailed below deal separately with the hydraulic motor, the pump element, the canister and the vapour vent valve on the canister.

It should be noted that when a pump element is removed, the replacement assembly will comprise a pump element with the hydraulic motor attached.

2. Hydraulic Motor (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 145 to 155 lbf in (1.638 to 1.751 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Torque spanner, 95 to 105 lbf in (1.073 to 1.186 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-

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DESCRIPTION	PART NO.
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 16 to 20 lbf in (0.181 to 0.226 mdaN)	-

B. Prepare to Remove Hydraulic Motor

(1) Depressurize the appropriate hydraulic system (Ref. 29-00-00) (LH motor, green system: RH motor, blue system).

(2) Electrically isolate the associated pump control and indication circuits by tripping the associated circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 GRN PUMP CONT	1-213	1Q 185	J18
TANK 11 GRN PUMP IND	15-216	1Q 186	D 2
TANK 11 BLUE PUMP CONT	3-213	2Q 185	F 5
TANK 11 BLUE PUMP IND	15-215	2Q 186	D22

(3) Release the fasteners and open service compartment door 153 FB in the bottom of the rear fuselage to gain access to the hydraulic motor.

(4) Position a receptacle to collect hydraulic fluid, then remove the motor bleed plug and disconnect the hydraulic supply and return pipes and the motor case drain pipe from the hydraulic motor.

C. Remove Hydraulic Motor

(1) Remove the attachment bolts and washers securing the hydraulic motor to the pump element and withdraw the motor. Remove and discard the gasket, then fit suitable blanks to the union adapters.

(2) If a replacement hydraulic motor is to be fitted, remove and retain the union adapters from the motor. Fit suitable blanks to the motor ports and refit the bleed plug.

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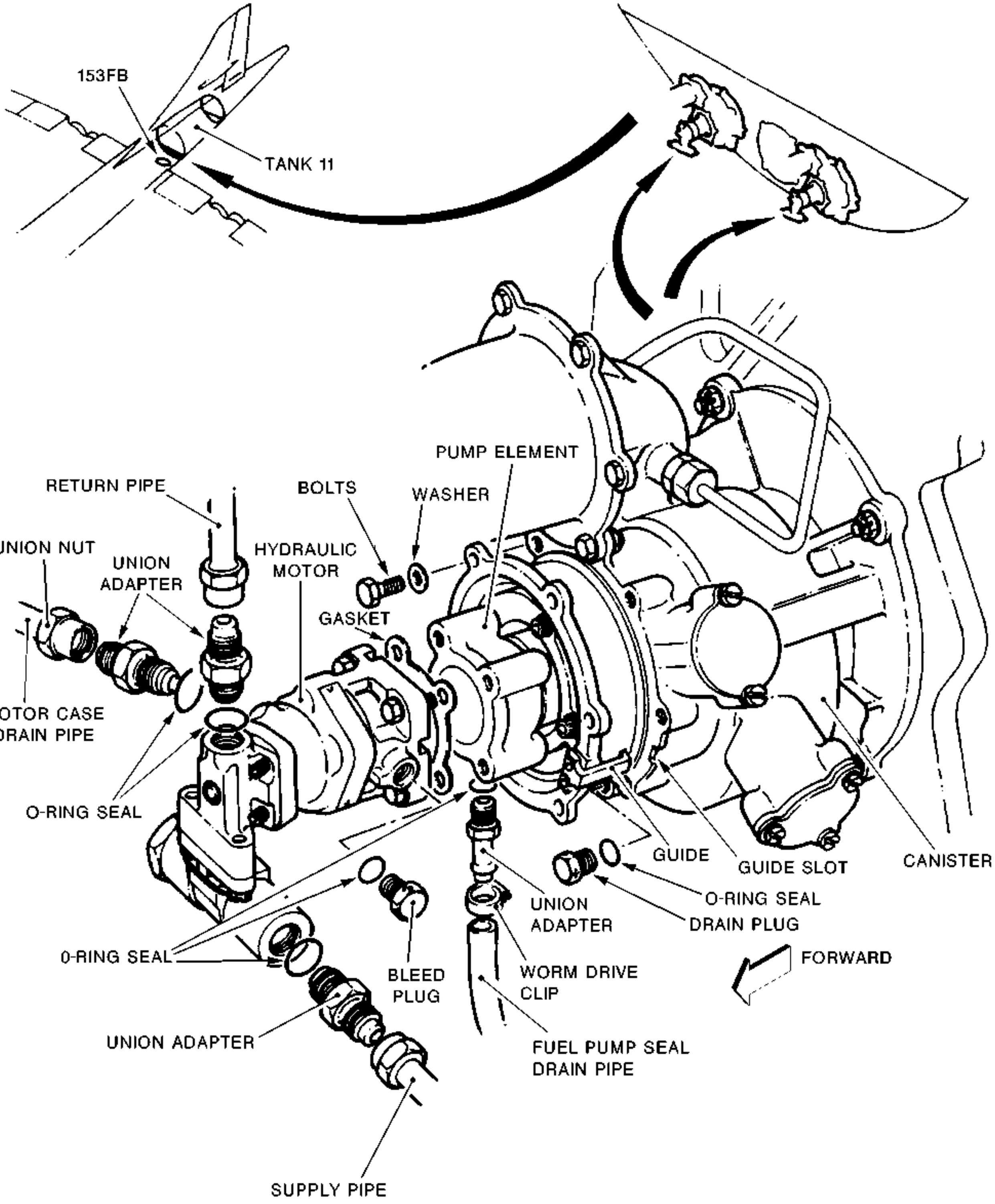

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Hydraulic Motor and Pump Element - Installation
Figure 401

(3) Fit suitable blanks to the open pipe unions. Clean up any spilled hydraulic fluid.

D. Prepare to Install Hydraulic Motor

(1) If a replacement hydraulic motor is to be installed, fit the union adapters removed from the original motor, using new O-ring seals, lubricated in accordance with 20-23-11. Torque-tighten the union adapters to the values shown below:

(a) Hydraulic supply: to between 145 and 155 lbf in (1.638 and 1.751 mdaN).

(b) Hydraulic return: to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(c) Motor case drain: to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(2) If the original hydraulic motor is to be reinstalled, refit the bleed plug, complete with new O-ring seal lubricated in accordance with 20-23-11, to the motor.

<u>NOTE</u>: Final torque-tightening and locking will be done on installation of the motor.

E. Install Hydraulic Motor

(1) Comply with the electrical and hydraulic safety precautions.

(2) Position and secure the hydraulic motor to the pump element with a new gasket, the attachment bolts and the washers. Torque-tighten the bolts to between 16 and 20 lbf in (0.181 and 0.226 mdaN), and wire-lock the bolts in accordance with 20-21-13.

(3) Remove the blanks from the union adapters and the pipe unions, then connect the hydraulic pipes and torque-tighten the union nuts to the values shown below:

(a) Supply pipe: to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(b) Return pipe: to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(c) Motor case drain pipe: to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

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(4) If the original motor is being reinstalled, torque-tighten the bleed plug to between 95 and 105 lbf in (1.073 and 1.186 mdaN). Wire-lock it to the nearest motor attachment bolt in accordance with 20-21-13.

F. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the pump element (Ref. Adjustment/Test).

(3) Check that the joints and unions that were disturbed are free from leakage.

(4) Remove the container and clean up any spilled hydraulic fluid.

(5) Shut and secure service compartment door 153 FB.

3. Pump Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Electrical bonding tester	-
Torque spanner, 95 to 105 lbf in (1.073 to 1.186 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 30 to 35 lbf in (0.339 to 0.395 mdaN)	-
Torque spanner, 16 to 20 lbf in (0.181 to 0.226 mdaN)	-

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B. Prepare to Remove Pump Element

(1) Carry out operations 2.B.(1) to (4).

(2) Slacken off the worm-drive clip and disconnect the pump seal drain pipe.

C. Remove Pump Element

(1) Remove the attachment bolts and washers securing the pump assembly (hydraulic motor and pump element) to the canister and withdraw the pump assembly until the hook stop on the guide contacts the canister flange.

NOTE: At this stage a hinged valve shuts under spring action to shut off the canister fuel inlet.

(2) Place a 0.5 gal (2.27 l) container under the canister drain plug, remove the drain plug and drain the fuel from the canister. Remove and discard the O-ring seal from the drain plug.

(3) Turn the pump assembly counter-clockwise until the guide aligns with the slot in the canister flange, then withdraw the pump assembly.

(4) Fit suitable blanks to the pump element ports, the adapter unions on the hydraulic motor and the open pipe unions.

(5) Unscrew, remove and retain the drain pipe union adapter from the pump element. Remove and discard the O-ring seal.

D. Prepare to Install Pump Element

(1) Using a new O-ring seal lubricated in accordance with 20-23-11, fit the drain pipe union adapter removed from the original pump element. Torque-tighten the adapter to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(2) Using a new O-ring seal lubricated in accordance with 20-23-11, fit the canister drain plug and torque-tighten it to between 45 and 55 lbf in (0.508 and 0.621 mdaN) and wire-lock it in accordance with 20-21-13.

(3) Fit three new sealing rings, lubricated in accordance with 20-23-11, to the grooves in the pump element housing.

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(4) Remove the blanks from the ports on the pump element.

E. Install Pump Element

(1) Comply with the hydraulic, fuel, and electrical safety precautions.

(2) Insert the pump element into the canister, align the guide with the slot in the canister, then push the pump assembly home and turn it clockwise until the attachment bolt holes are in alignment.

(3) Hold the pump assembly in this position and secure it with the attachment bolts and washers. Torque-tighten the bolts in diametrically opposite sequence to between 30 and 35 lbf in (0.339 and 0.395 mdaN).

(4) Using the electrical bonding tester, check that the resistance between the pump assembly and canister is not greater than 0.025 ohm.

(5) Connect the seal drain pipe to the pump element and tighten the worm-drive clip.

(6) Remove the blanks from the union adapters on the hydraulic motor and the pipe unions, then connect the hydraulic pipes. Torque-tighten the union nuts to the values shown below:

(a) Supply pipe: to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(b) Return pipe: to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(c) Motor case drain pipe: to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

F. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the pump element (Ref. Adjustment/Test).

(3) Check that the hydraulic and fuel joints and pipelines that were disturbed are free from leakage.

(4) Remove all containers and clean up any spilled hydraulic fluid and fuel.

(5) Shut and secure service compartment door 153 FB.

4. Canister (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 150 lbf in (1.695 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-

B. Prepare to Remove Canister

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

(1) Drain the fuel tank (Ref. 28-25-00, Servicing).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(2) Drain the trim transfer pipe as follows:

(a) Position a clean container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

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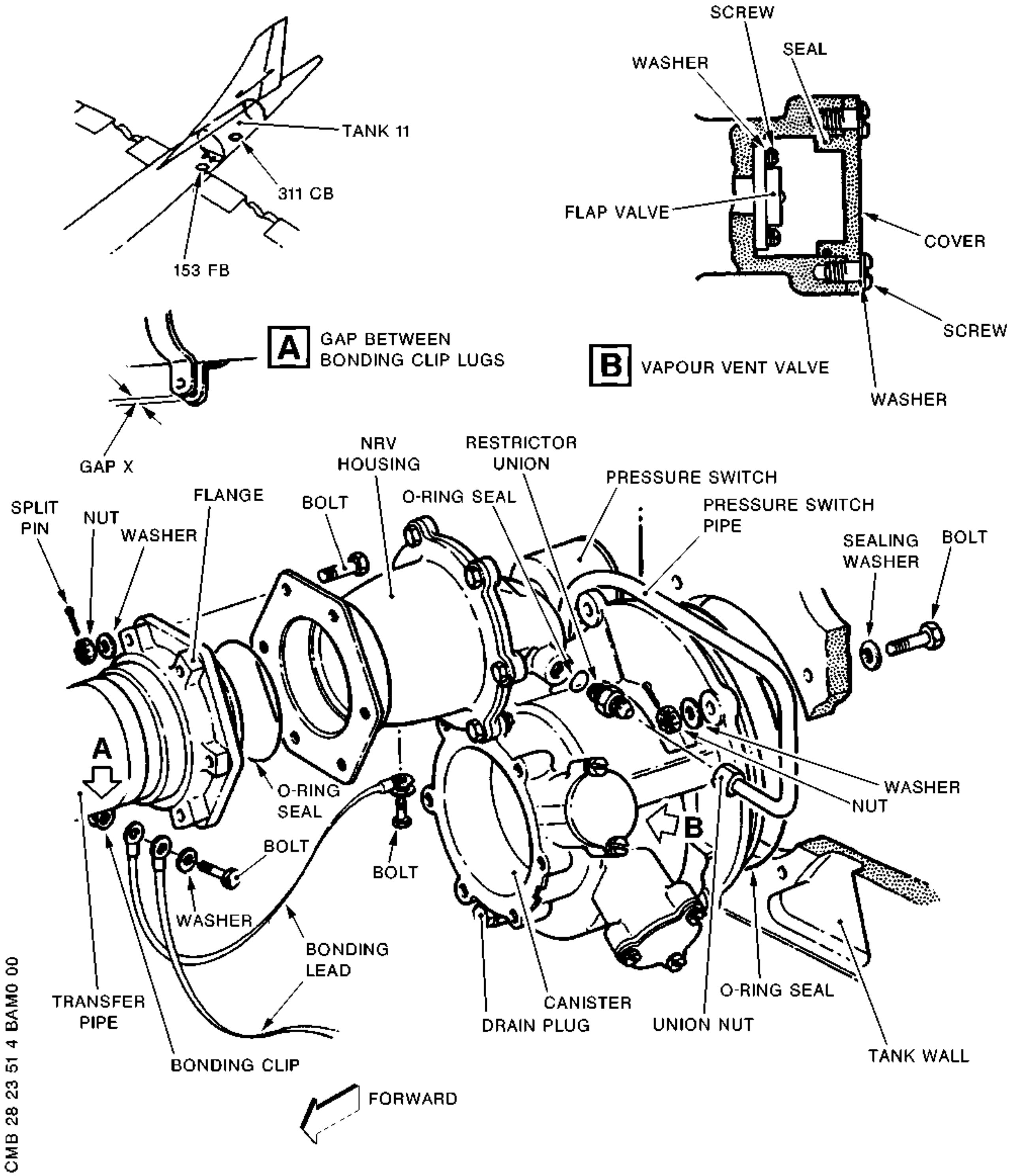

Canister - Installation
Figure 402

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(f) Remove the container.

(3) Remove the pump element (Ref. para.3.).

(4) Remove tank panel 311 AB to gain access to the canister attachment bolts.

(5) Disconnect and remove the pressure switch pipe by unscrewing the union nuts at the pressure switch and the canister. Fit suitable blanks to the union adapters.

(6) Disconnect the bonding leads and clip from the fuel transfer pipe.

C. Remove Canister

(1) Disconnect and remove the fuel transfer pipe (Ref. 28-23-00, Removal/Installation).

(2) Remove the split pins, then unscrew and remove the nuts, washers, bolts and sealing washers securing the canister to the tank wall and withdraw the canister.

(3) Remove and discard the O-ring seal from the canister mounting spigot.

(4) If a replacement canister is to be fitted, remove and retain the pressure switch pipe restrictor union.

(5) Fit suitable blanks to the canister ports and apertures.

D. Prepare to Install Canister

(1) Remove the blanks from the ports and apertures in the canister. Ensure that all joint faces are clean.

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(2) If a replacement canister is to be installed, fit the pressure switch pipe restrictor union removed from the original canister, using a new O-ring seal, lubricated in accordance with 20-23-11. Torque-tighten the union to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, in the canister spigot.

E. Install Canister

(1) Position the canister, then from inside the fuel tank insert the attachment bolts, each with a new sealing washer under the head so that the seal is against the tank wall. Secure the canister with the washers and nuts. Torque-tighten the nuts to 150 lbf in (1.695 mdaN) and lock them with split pins in accordance with 20-21-12.

(2) Fit the fuel transfer pipes (Ref. 28-23-00, Removal/Installation).

(3) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 401 (Ref. Fig. 402). Connect the bonding lead, in accordance with 20-27-11, using the bolts, washers and nuts. Torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(4) Torque-tighten the bolt, to the NRV housing, to between 40 and 45 lbf in (0.452 and 0.508 mdaN). Check that the bonding is in accordance with 20-27-11.

(5) Position and secure the pressure switch pipe. Torque-tighten the union nuts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

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GAP X, WITH LUGS HELD TOGETHER BY FINGER PRESSURE	SPACING WASHER(S) TO BE FITTED BETWEEN LUGS	
	WASHER	QTY.
0.010 to 0.059 in (0.254 to 1.498 mm)	-	0
0.060 to 0.119 in (1.524 to 3.022 mm)	Y	1
0.120 to 0.169 in (3.048 to 4.292 mm)	Z	1
0.170 to 0.209 in (4.318 to 5.308 mm)	Y and Z	1 of each

NOTE: Washer Y thickness: 0.048 in (1.219 mm)

Washer Z thickness: 0.104 in (2.641 mm)

Bonding Clip Lug Gap and Spacing Washers (Ref. Fig.402)
Table 401

F. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) Ensure that the mating faces of the tank access panel and structure are clean.

R (3) Fit a new door seal, lubricated with petroleum jelly.

R (4) Refit the panel as follows:

(a) Simultaneously, insert the door bolts from the LH and RH sides of the door and progressively work toward the centre. Hand-tighten the bolts in the same procedure.

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(b) Alternatively, working from the LH and RH sides of the door and progressively toward the centre, torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(c) Repeat the above operation (b), but torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

R (5) Check that the electrical resistance between the panel and adjacent structure is in accordance with 20-27-11.

R (6) Install the pump element (Ref. para.3.).

R (7) After refuelling, check the tank access panel for freedom from leakage.

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5. Canister Flap Valve (Vapour Vent) (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Screwdriver torque fixture, 3 to 5 lbf in (0.034 to 0.056 mdaN)	-
Screwdriver torque fixture, 5 to 7 lbf in (0.056 to 0.079 mdaN)	-

B. Prepare to Remove Flap Valve

(1) Drain the tank (Ref. 28-25-00, Servicing).

(2) Electrically isolate the appropriate pump control and indication circuits by tripping the associated circuit breakers (Ref. para.2.). Fit safety clips.

(3) Release the fasteners and open service compartment door 153 FB to gain access to the valve.

C. Remove Flap Valve

(1) Remove the valve cover by unscrewing the securing screws and washers. Discard the cover seal.

(2) Remove the securing screws and washers and withdraw the flap valve.

D. Install Flap Valve

(1) Observe the fuel and electrical safety precautions.

CAUTION: UNEVEN TIGHTENING OF SCREWS CAN DISTORT THE MOUNTING ASSEMBLY AND CAUSE MALFUNCTIONING.

(2) Position and secure a new flap valve with the screws and washers. Torque-tighten the screws to between 3 and 5 lbf in (0.034 and 0.056 mdaN).

(3) Fit a new O-ring seal, lubricated in accordance with 20-23-11, then position and secure the cover with the screws and washers. Torque-tighten the screws to between 5 and 7 lbf in (0.056 and 0.079 mdaN).

E. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test and a Leakage Test of the canister (Ref. Adjustment/Test).

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HYDRAULIC PUMP UNIT - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE HYDRAULIC SAFETY PRECAUTIONS DETAILED IN 29-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The two hydraulic pump units for tank 11 are identical. Each unit comprises a pump element, a hydraulic motor and an isolation canister which is bolted to the outside of the front wall of the tank. The motors receive hydraulic pressure supplies via solenoid-operated selector valves which are controlled by separate switches on the fuel management panel at the third crew member's station.

Other controls and indicators required for the test are on the fuel management panel. Access to both pump units is gained
R by removing a panel in the bottom of the fuselage.

R This topic comprises Functional Tests of the pump element and the isolation canister. Operational and System Tests are not applicable.

R 2. Functional Test - Pump Element

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (3) Remove access panel 153 FB in the bottom of the fuselage to gain access to the pump unit.

WARNING: OBSERVE THE FUEL LOADING LIMITATIONS DETAILED IN 28-25-00, SERVICING, WHEN REFUELLING OR TRANSFERRING FUEL.

R (4) Ensure that tank 11 contains sufficient fuel for the
R test (approximately 1,000 kg). Refuel (Ref. 12-11-28)
R if necessary, observing the fuel loading limitations.

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(5) Ensure, by reference to the fuel quantity indicators (FQIs), that tank 9 has the capacity to receive at least 1,000 kg of fuel. Defuel (Ref. 28-25-00, Servicing) or transfer fuel if necessary.

B. Test

(1) Check that there is no fuel leakage from the element-to-canister and canister-to-tank joints.

(2) Pressurize the appropriate hydraulic system (LH pump - green system, RH pump - blue system), using the ground pressurizing system (Ref. 29-23-00).

(3) Set the appropriate PUMP switch to "ON" and check that the LOW PRESS caption is illuminated and then extinguished after 3 s, indicating the correct build-up of pump pressure.

R (4) Set the tank 9 INLET VALVE MAIN switch (LH or RH, as
R required) to "OPEN" and check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes and then to bar-in-line.

(5) Check, by reference to the FQIs, that the fuel transfer flow rate from tank 11 to tank 9 is not less than 320 kg/min over a minimum period of 3 min.

(6) Set the PUMP switch to "OFF".

(7) Set the INLET VALVE MAIN switch to "SHUT".

C. Conclusion

(1) Switch off and disconnnect electrical ground power as detailed in 24-41-00.

R (2) Refit the access panel 153 FB as detailed in 53-00-00,
R Removal/Installation.

3. Functional Test - Isolation Canister

A. Prepare

(1) Defuel and drain tank 11 (Ref. 28-25-00, Servicing).

R (2) Ensure that tank 9 contains 5,000 kg of fuel.

R (3) Make available electrical ground power as detailed in 24-41-00.

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R (4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (5) Remove the access panel 153 FB in the bottom of the fuselage to gain access to the pump unit.

R (6) Remove the pump element (Ref. Removal/Installation).

B. Test

(1) Manually operate the fuel inlet valve in the canister. Check for full and free movement and ensure that the valve returns and seats correctly under spring pressure.

(2) Position a suitable container to collect fuel that will leak from the canister when the system is pressurized.

(3) Pressurize the appropriate trim transfer system (LH or RH) with fuel as follows:-

(a) Set tank 9 PUMP switch to "ON".

(b) Set tank 11 INLET VALVE MAIN switch to "OPEN" for 1 min to bleed the system of air.

(c) Set tank 11 INLET VALVE MAIN switch to "SHUT" and check that the magnetic indicator display changes from bar-in-line to diagonal stripes, and then to bar-across-line.

(4) Check that there is no fuel leakage from the flanged joint between the pipe and the non-return valve housing.

R (5) Check that the fuel leakage past the non-return valve and through the canister does not exceed 350 cc/min.

R (6) Set the PUMP switch to "OFF".

R (7) Install the pump element (Ref. Removal/Installation).

R <u>WARNING:</u> ENSURE THAT EXISTING FUEL LOADING WILL PERMIT
R TANK 11 TO BE REFUELLED WITHOUT AIRCRAFT
R OVERBALANCE OCCURRING. REFERENCE SHOULD BE
R MADE TO THE WEIGHT AND BALANCE MANUAL, BUT FOR
R MOST AIRCRAFT ZERO FUEL WEIGHTS AND ZERO FUEL
R CGs, TANKS 10, 1 and 4 WILL HAVE TO BE FULL
R AND ALL OTHER TANKS (EXCEPT 9 AND 11) WILL

HAVE TO BE EMPTY.

R (8) Refuel the tank (Ref. 12-11-28) to 5,500 kg capacity.

(9) Check that there is no fuel leakage from the canister-to-tank and pump element-to-canister joints.

(10) Set tank 9 INLET VALVE MAIN switch (LH or RH, as required) to "OPEN". Check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes and then to bar-in-line.

(11) Check, by reference to the fuel quantity indicators, that there is no gravity fuel transfer from tank 11 over a minimum period of 15 min.

(12) Set the INLET VALVE MAIN switch to "SHUT".

C. Conclusion

(1) Set all fuel management panel switches to their normal ground settings (Ref. 28-00-00, Servicing).

(2) Carry out a Functional Test of the pump element (Ref. para.2).

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PUMP PRESSURE SWITCH (TANK 11) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pressure switches, one to each hydraulically operated fuel transfer pump, are mounted on the forward wall of tank 11, each switch near its associated pump. The switches, which are connected to the pump outlets, sense low pressure output from the pumps and give indication of this by illuminating warning captions on the fuel management panel in the flight compartment.

2. Pressure Switch

**ON A/C 001-004,
(Ref. Fig. 401)

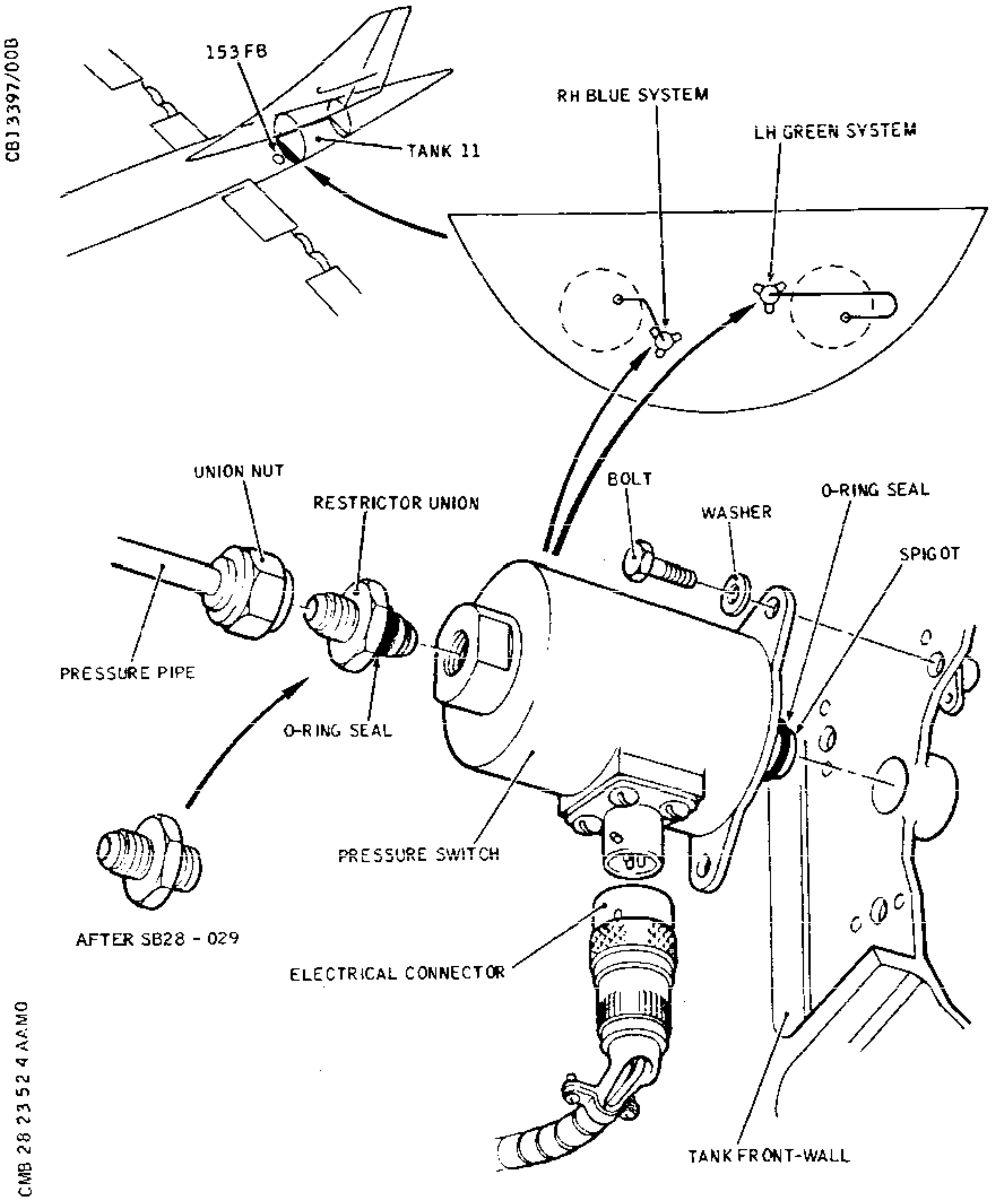
R **ON A/C 005-007,
(Ref. Fig. 402)

A. Equipment and Materials

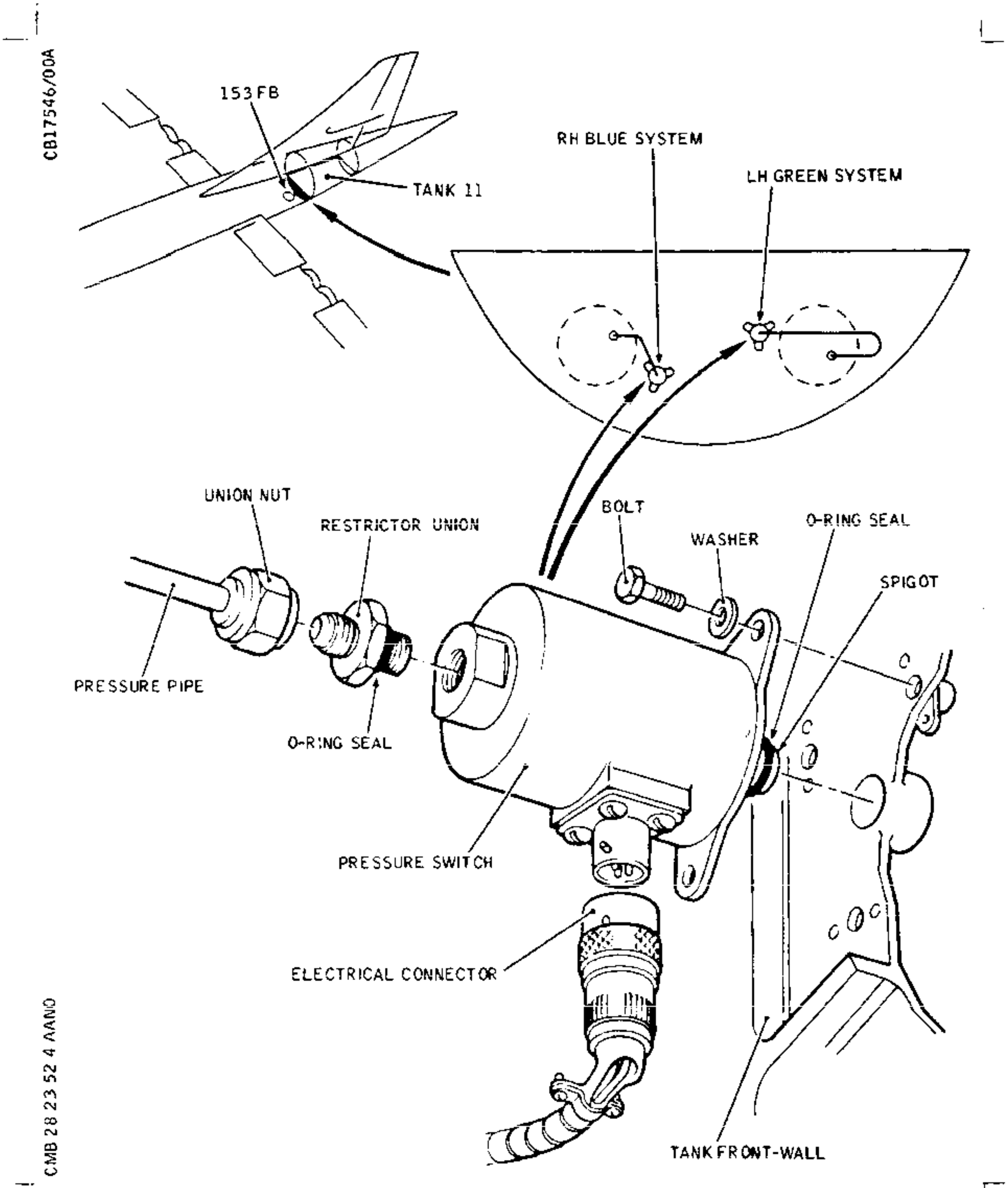
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 107 to 117 lbf in (1.209 to 1.322 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-

B. Prepare

(1) Ensure that the fuel management panel switches are in their usual ground positions and that the refuel control panel access door is closed. Place placards on the panels, warning that the settings of the switches must not be altered.



Pump Pressure Switch - Installation
R Figure 401



Pump Pressure Switch - Installation
Figure 402

(2) Defuel tank 11 (Ref. 28-25-00, Servicing).

(3) Electrically isolate the appropriate pump control and indication circuits by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 GRN PUMP CONT	1-213	1Q185	J18
TANK 11 GRN PUMP IND	15-216	1Q186	D2
TANK 11 BLUE PUMP CONT	3-213	2Q185	F5
TANK 11 BLUE PUMP IND	15-215	2Q186	D22

(4) Open service door 153 FB in the rear fuselage belly to gain access to the pressure switch.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the pressure pipe from the pressure switch by unscrewing the union nut.

(3) Remove the attachment bolts and washers and withdraw the switch from the tank wall. Fit a suitable blank to the port at each end of the switch. If a replacement switch is to be fitted, remove and retain
R the restrictor union before blanking off the ports.

(4) Fit suitable blanks to the open pressure pipe union nut and to the aperture in the tank wall.

D. Prepare to Install

R NOTE: In operation (1) the restrictor union must be
R fitted with its smaller diameter bore in the
R pressure switch.

(1) If a replacement pressure switch is to be installed,
R fit the restrictor union removed from the original switch, using a new O-ring seal, lubricated in

R accordance with 20-23-11. Torque-tighten the union to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(2) Remove the blank from the pressure switch, then fit a new O-ring seal, lubricated in accordance with 20-23-11, in the groove in the pressure switch spigot.

E. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blank from the aperture in the tank wall, place the pressure switch in position and insert the spigot into the aperture; ensure that the O-ring seal is in position, then push the switch in and secure it with the attachment bolts and washers. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN) and wire-lock them to each other in accordance with 20-21-13.

(3) Ensure that the electrical bonding is in accordance with 20-27-11.

(4) Remove the blank from the pressure pipe union nut, then connect the union nut to the pressure switch. Torque-tighten the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(5) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the pressure switch (Ref. Adjustment/Test).

(3) Shut and secure the service door removed to gain access to the pressure switch.

(4) Remove the placards from the management and refuelling panels.

PUMP PRESSURE SWITCH (TANK 11) - ADJUSTMENT/TEST

WARNING: OBSERVE THE HYDRAULIC SAFETY PRECAUTIONS DETAILED IN 29-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pressure switches are mounted on the forward wall of tank 11, each near its associated hydraulically operated fuel pump. Each pressure switch controls the illumination of a warning caption on the fuel management panel in the flight compartment.

The Functional Test detailed below verifies the correct operation of the pressure switch. System and Operational Tests are not considered necessary in this application.

2. Functional Test

WARNING: WHEN REFUELLING, DEFUELLING OR TRANSFERRING FUEL, OBSERVE THE FUEL LOAD DISTRIBUTION LIMITATIONS (REF. 28-25-00, SERVICING).

A. Prepare

(1) Ensure that there is fuel in the tank.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Connect the hydraulic supply rig (Ref. 29-00-00) to the ground connector of the hydraulic system appropriate to the pressure switch. (LH switch, green system; RH switch, blue system).

(4) Open service door 153 FB in the rear fuselage belly.

B. Test

(1) Operate the hydraulic rig and pressurize the hydraulic system (Ref. 29-00-00) to 4,000 psig (272 bar).

(2) On the fuselage management panel set the associated pump selector control switch to "ON" and check that the LOW PRESS caption is illuminated, and that it is extinguished within 3 s, indicating that the pump is operating.

(3) Trip the associated pump selector control circuit breaker and check that the LOW PRESS caption is illuminated, indicating that the pressure failure is sensed by the pressure switch. Reset the circuit breaker.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 GRN PUMP CONT	1-213	1Q185	J18
TANK 11 BLUE PUMP CONT	3-213	2Q185	F5

(4) With the hydraulic pump operating, check the pressure switch and pipe unions for leakage during a minimum period of 5 min. No leakage is permissible.

(5) Set the pump selector control switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Disconnect the hydraulic supply rig (Ref. 29-00-00).

(3) Shut and secure service door 153 FB.

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PUMP UNIT (ELECTRICAL) - TANK 11 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two electrically operated pump units are installed in the bottom of tank 11. Each unit comprises a pump element and an isolating canister. The pump element fits into, and is bolted to, the canister, which in turn is bolted to the bottom of the tank. A pump element may be removed without draining the tank but to remove a canister the tank must first be drained.

The procedures detailed below deal separately with the removal and installation of the pump element, the canister and the canister flap relief and non-return valves.

The canister non-return valve, fitted to the forward canister only, and the canister flap relief valves may be removed and installed without removing the canister.

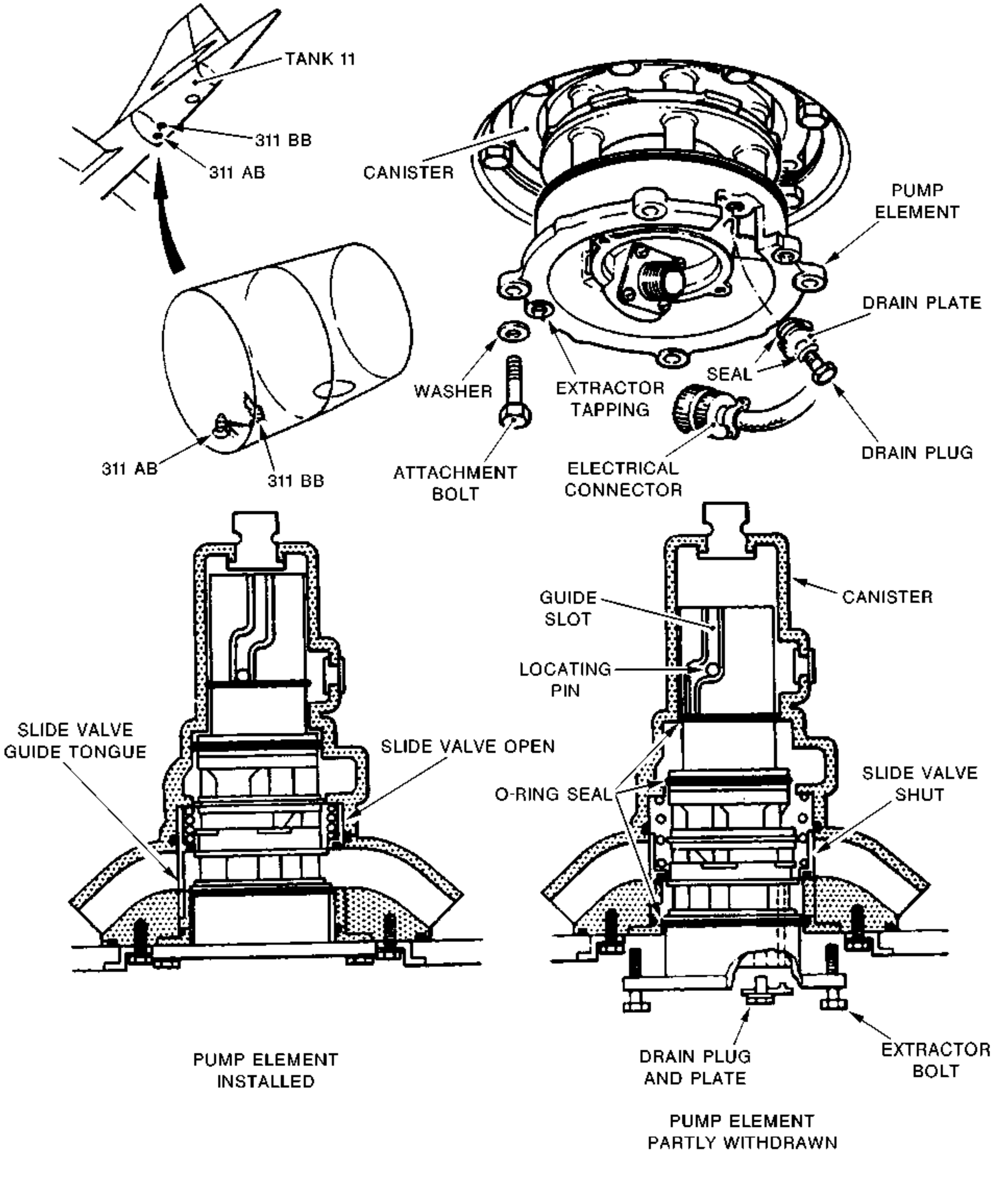
2. Pump Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Electrical bonding tester	-
Torque spanner, 45 to 55 lbf in (0.51 to 0.62 mdaN)	-
Torque spanner, 99 to 101 lbf in (1.12 to 1.14 mdaN)	-

B. Prepare to Remove Pump Element

(1) Ensure that the fuel management panel switches are in their normal ground positions (Ref. 28-00-00, Servicing). Place a placard on the panel warning that the positions of the switches must not be altered.



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Pump Element - Installation
Figure 401

(2) Electrically isolate the pump control and indication circuits by tripping the appropriate circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH PUMP SUP	13-216	Q1375	F 4
TANK 11 LH PUMP IND	15-215	Q1388	E21
TANK 11 RH PUMP SUP	13-215	Q1376	E16
TANK 11 RH PUMP IND	15-216	Q1389	C 5

(3) Release the fasteners and open the cover 311 AB (forward) or the cover 311 BB (rear) to gain access to the pump element.

(4) Disconnect the electrical connector from the pump element.

(5) Place a suitable container in position to collect any fuel that may drain from the pump element.

(6) Slacken off the drain plug in the pump element sufficiently to facilitate subsequent removal.

C. Remove Pump Element

(1) Remove the bolts and washers attaching the pump element to the canister, then fit two of the bolts into the extractor tappings in the pump element, screw the bolts in evenly and extract the pump element approximately 1.0 in (25.4 mm).

NOTE: At this stage the slide valve in the canister will have seated, thus shutting off the canister port.

(2) Remove the drain plug and plate and drain the canister (approximately 2.0 pints (1.0 l)).

(3) Remove the extractor bolts.

(4) Turn the pump element counter-clockwise until checked by the guide slot, then withdraw the pump element.

(5) Remove and discard the sealing rings from the pump element and temporarily fit the drain plug and plate.

(6) Fit a suitable blank to the canister opening.

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D. Prepare to Install

(1) Remove the drain plug and plate from the pump element. Remove and discard the seals. Fit new seals, lubricated in accordance with 20-23-11, then refit the drain plate and plug. Temporarily tighten the drain plug.

(2) Fit new sealing rings, lubricated in accordance with 20-23-11, to the pump element.

(3) Remove the blank from the canister opening.

E. Install Pump Element

(1) Observe the fuel and electrical safety precautions.

(2) Insert the pump element into the canister so that the guide slot engages the locating pin in the canister. Slide the pump element in until it is stopped by the slot, then turn in clockwise and push it fully in. Hold it in this position, align the bolts holes and secure the pump element to the canister with the bolts and washers. Torque-tighten the bolts to between 45 and 55 lbf in (0.51 and 0.62 mdaN).

(3) Using the bonding tester, check that the electrical resistance between the pump element and the canister is in accordance with 20-27-11.

(4) Finally, torque-tighten the drain plug to between 99 and 101 lbf in (1.12 and 1.14 mdaN) and wire-lock it to the nearest attachment bolt in accordance with 20-21-13.

(5) Connect the electrical connector to the pump element, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Remove the safety clips and set the circuit breakers tripped before removal.

(2) Carry out an Operational Test and a Leakage Test of the pump element (Ref. Adjustment/Test).

(3) Secure and fasten the cover opened to gain access to the pump element.

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3. Canister (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Electrical bonding tester	-
Torque spanner, 12 to 15 lbf in (0.14 to 0.17 mdaN)	-
Torque spanner, 28 to 32 lbf in (0.31 to 0.36 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.51 to 0.62 mdaN)	-
Petroleum jelly (Ref. 20-30-00, No.27)	-

B. Prepare to Remove Canister

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

(1) Drain the fuel tank (Ref. 28-25-00).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(2) Drain the trim transfer pipe as follows:

(a) Position a clean container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

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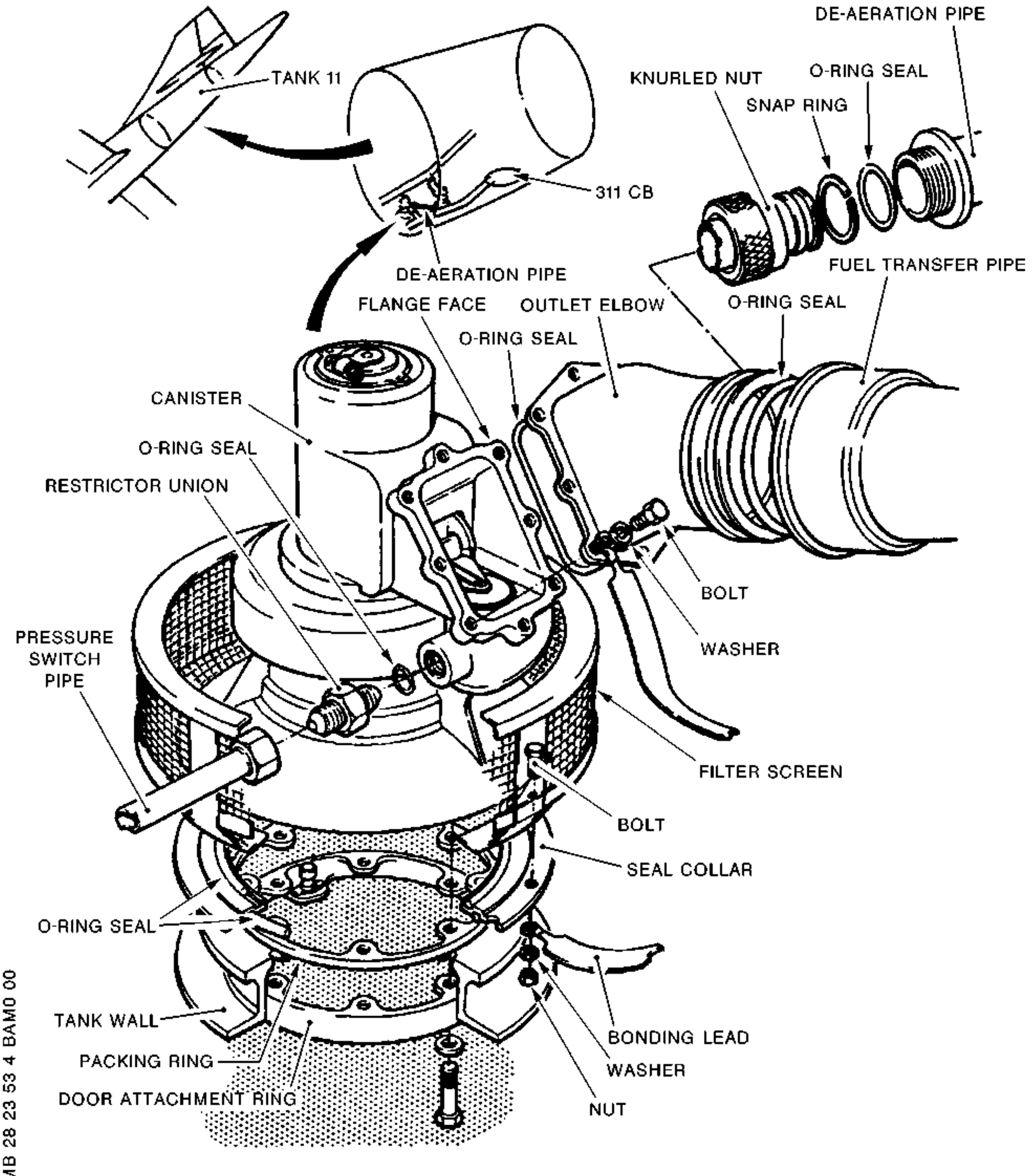

Canister - Installation
Figure 402

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(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(f) Remove the container.

(3) Remove the pump element (Ref. para.2.).

(4) Remove the tank panel 311 CB to gain access to the canister.

(5) From inside the tank proceed as follows:

(a) Disconnect the bonding lead from the seal collar/filter screen assembly by removing the nut, washer and bolt.

(b) Disconnect the pressure switch pipe by unscrewing the union nut. Fit a suitable blank to the open end of the pipeline.

(c) Disconnect the de-aeration pipe from the canister outlet elbow (forward canister only) by lifting the locking clip and unscrewing the knurled nut. Remove and discard the O-ring seal.

(d) Remove the attaching bolts and washers and disconnect the outlet elbow from the canister. Disconnect the bonding lead, and remove the tabwasher to which the pressure pipe union nut was wire-locked.

C. Remove Canister

(1) From outside the tank unscrew the bolts and washers securing the canister to the tank and withdraw the door attachment ring.

(2) From inside the tank remove the following:

(a) The canister.

(b) The seal collar complete with filter screen.

(c) The packing ring.

(d) The outlet elbow from the fuel transfer pipe.

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(3) If a replacement canister is to be fitted, remove and retain the pressure pipe restrictor union from the canister.

(4) Fit suitable blanks to the ports of the canister and the tank aperture.

D. Prepare to Install Canister

(1) Remove the blanks from the canister ports and the tank aperture. Ensure that the mating faces of the aperture are clean and free from damage.

(2) Ensure that the mating faces of the door attachment ring, the packing ring and the canister are clean and free from damage.

(3) Clean the grooves in the seal collar and ensure that the mating faces are clean and free from damage.

CAUTION: ENSURE THAT THE EXPOSED FACES OF THE SEALS ARE KEPT FREE FROM ADHESIVE.

(4) Bond new seals to the grooves with Viton PR 1720SM adhesive in accordance with 20-22-21.

(5) Fit new O-ring seals, lubricated in accordance with 20-23-11, to the fuel transfer and the de-aeration pipe ends of the outlet elbow, then insert the outlet elbow in the fuel transfer pipe in the tank and align it with the de-aeration pipe.

(6) If a new canister is to be fitted, proceed as follows:

(a) Using a new O-ring seal lubricated in accordance with 20-23-11, fit the pressure switch pipe restrictor union removed from the original canister. Torque-tighten the union to between 45 and 55 lbf in (0.51 and 0.62 mdaN).

CAUTION: DO NOT OPERATE THE VALVE IN A DRY CONDITION.

(b) Spray the canister slide valve with fuel, then check that it slides open easily and shuts by spring action.

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E. Install Canister

(1) Observe the fuel and electrical safety precautions.

(2) Inside the tank, and over the tank aperture, position firstly the packing ring, then the seal collar/filter screen assembly and lastly the canister.

(3) Align the bolt holes, ensuring that the bonding lead attachment bolt hole on the seal collar/filter screen assembly is in line with the bonding lead and the canister flange face is opposite the transfer pipe and outlet elbow.

(4) Position the door attachment ring over the tank aperture outside the tank, line up the attachment bolt holes, then secure the whole assembly with the bolts and washers.

(5) Torque-tighten the bolts in diametrically opposite sequence to between 45 and 55 lbf in (0.51 and 0.62 mdaN) and wire-lock them in pairs in accordance with 20-21-13. Ensure that the wire-locking does not obstruct the pump element attachment bolt holes.

(6) Inside the tank proceed as follows:

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, in the groove in the canister flange face and secure the outlet elbow to the canister with the bolts and washers. Connect the bonding lead and secure the pressure switch pipe union locking tabwasher in the position noted before removal. Torque-tighten the bolts to between 28 and 32 lbf in (0.31 and 0.36 mdaN).

(b) Connect the outlet elbow to the de-aeration pipe (forward canister only) with the knurled nut. Tighten the nut by hand until the nut abuts the sleeve flange and the locking clip engages the lug.

(c) Connect the pressure switch pipe to the canister. Torque-tighten the union nut to between 45 and 55 lbf in (0.51 and 0.62 mdaN) and wire-lock it to the tabwasher on the canister flange face in accordance with 20-21-13.

(d) Connect the bonding lead to the seal collar with the bolt, washer and nut. Torque-tighten the nut to between 12 and 15 lbf in (0.14 and 0.17 mdaN) and lock it with a split pin in accordance with 20-21-12.

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F. Conclusion

(1) Using the bonding tester, check that the electrical resistance between the canister and the tank wall is in accordance with 20-27-11.

(2) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(3) Ensure that the mating faces of the tank access panel and structure are clean.

(4) Fit a new door seal, lubricated with petroleum jelly.

(5) Refit the panel as follows:

(a) Simultaneously, insert the door bolts from the LH and RH sides of the door and progressively work toward the centre. Hand-tighten the bolts in the same procedure.

(b) Alternately, working from the LH and RH sides of the door and progressively toward the centre, torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(c) Repeat the above operation (b), but torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(6) Check that the electrical resistance between the panel and adjacent structure is in accordance with 20-27-11.

(7) Refuel the tank (Ref. 12-11-28).

(8) Carry out a Functional Test and a Leakage Test of the canister (Ref. Adjustment/Test).

(9) Install the pump element as detailed in paragraph 2.

(10) After refuelling, check the tank access panel for freedom from leakage.

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4. Flap Relief Valve (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Hexagonal key	-
Right-angled torque spanner, 9 to 11 lbf in (0.10 to 0.12 mdaN)	Plessey 558-4-03288
Torque screwdriver, 9 to 11 lbf in (0.10 to 0.12 mdaN)	-
Torque screwdriver, 3 to 5 lbf in (0.03 to 0.06 mdaN)	-

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B. Prepare to Remove Flap Relief Valve

(1) Drain the tank (Ref. 28-55-00, Servicing).

(2) Remove the pump element (Ref. para.2.).

C. Remove Flap Relief Valve

(1) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers securing the flap valve mounting adapter to the canister and withdraw the mounting adapter, complete with flap valve.

(2) Remove the screws and washers securing the flap valve to the mounting and remove the valve. Remove and discard the sealing ring.

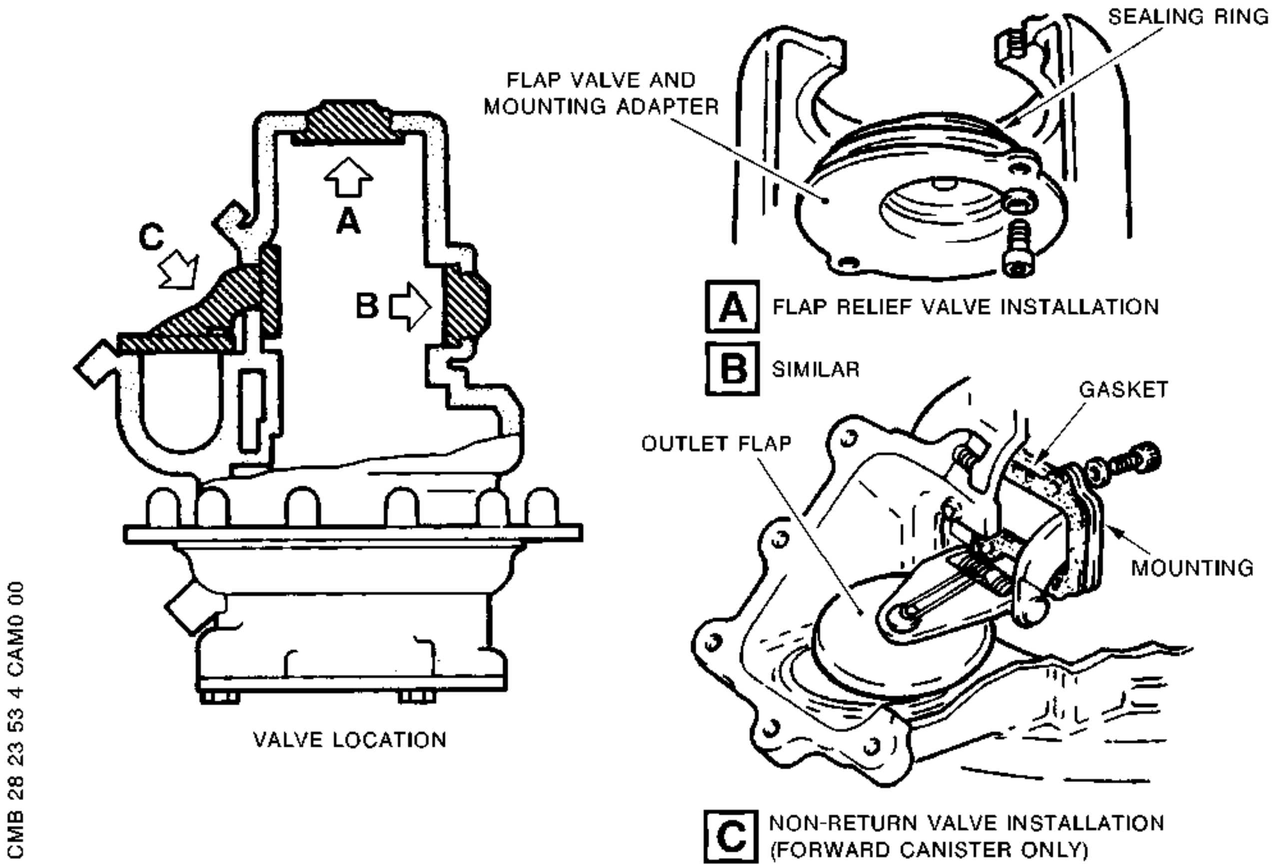
D. Install Flap Relief Valve

(1) Fit a new flap valve to the mounting adapter; torque-tighten the securing screws to between 3 and 5 lbf in (0.03 and 0.06 mdaN).

(2) Fit a new sealing ring, lubricated in accordance with 20-23-11, in the groove around the mounting adapter.

CAUTION: WHEN A SIDE-MOUNTED VALVE IS REFITTED (DETAIL B), ENSURE THAT THE VALVE IS POSITIONED WITH THE HINGE UPPERMOST.

TIGHTEN THE SCREWS EVENLY. UNEVEN TIGHTENING CAN DISTORT THE VALVE MOUNTING PLATE AND CAUSE MALFUNCTIONING.



Canister Valves - Installation
Figure 403

(3) Locate the mounting adapter in its bore from within the canister, aligning the attachment holes. Fit the securing washers and screws, and torque-tighten the screws to between 9 and 11 lbf in (0.10 and 0.12 mdaN).

(4) Check that the flap valve opens, then returns and seats correctly when released.

(5) Refuel the tank (Ref. 12-11-28).

(6) Check the flap valve for leakage of fuel. The total leakage from all the canister valves must not exceed 83 cc/min.

E. Conclusion

(1) Install the pump element (Ref. para.2.).

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5. Non-return Valve (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Right-angled torque spanner, 9 to 11 lbf in (0.10 to 0.12 mdaN)	Plessey 558-4-03288
Hexagonal key	-
Locking compound, Loctite Grade A (Ref. 20-30-00, No.109)	-
Sealing compound, PR 1005L (Ref. 20-30-00, No.372)	-
Methylethylketone, for removing sealing compound (Ref. 20-30-00, No.470)	-

B. Prepare to Remove Non-return Valve

(1) Remove the pump element (Ref. para.2.).

(2) Drain the tank (Ref. 28-25-00, Servicing), in which the isolation canister is fitted.

C. Remove Non-return Valve

(1) Manually operate the non-return valve in the canister and drain the residual fuel from the fuel feed pipe into a clean receptacle of approximately 10 gal (45.4 l) capacity.

(2) From within the bore of the canister, using a suitable hexagonal key, remove the screws and washers and carefully withdraw the non-return valve assembly, complete with gasket, from the outlet bore.

NOTE: When removing the screws, the pressure applied by the spring will cause the valve mounting to tilt toward the centre of the canister bore.

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D. Install Non-return Valve

NOTE: METHYLETHYLKETONE IS BOTH HIGHLY FLAMMABLE AND TOXIC. IT IS ESSENTIAL THAT THE UTMOST CARE AND ALL NECESSARY PRECAUTIONS ARE TAKEN WHEN USING THIS CLEANING AGENT.

(1) Using methylethylketone, remove the old gasket and clean and degrease the gasket groove on the face of the non-return valve mounting.

(2) Lightly coat one side of a new gasket with sealing compound, PR 1005L, and leave for approximately 20 min until the sealant is tack-free.

(3) Fit the gasket to the face of the non-return valve mounting with the sealant contacting the groove. Ensure that no sealant is on the untreated side of the gasket or on the face of the mounting not in contact with the gasket. Remove any surplus sealant, using methylethylketone.

(4) Position the new non-return valve assembly in the canister with the flap valve spring uppermost. Guide the flap valve into the outlet duct and secure the mounting and gasket to the isolation canister wall with the washers and screws, with the screws previously treated with Loctite Grade A.

NOTE: As the fitting of the non-return valve to the isolation canister is a non-handed operation, it is advised that the top two screws are engaged first to counteract the tendency of the spring to tilt the mounting.

(5) Evenly tighten the screws and, before they are fully tightened, ensure that the mounting plate spigot has entered the outlet duct. Using the right-angled torque spanner, torque-tighten the screws to between 9 and 11 lbf in (0.10 and 0.12 mdaN).

(6) Refuel the tank (Ref. 12-11-28).

(7) Check the valve for leakage of fuel. The total leakage from all valves in the isolation canister must not exceed 83 cc/min.

E. Conclusion

(1) Install the pump element (Ref. para.2.).

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PUMP UNIT (ELECTRICAL) TANK 11 - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two electrically-operated pump units are installed in the bottom of tank 11. The forward pump supplies the LH trim transfer pipe system and the associated tank de-aeration system. The rear pump supplies the RH trim transfer pipe system.

Access to the pump units is gained by removing panels in the bottom of the rear fuselage.

Controls and indicators are on the fuel management panel (3CM). Both pump units are similar and the following procedures detail an Operational Test applicable to a pump element, followed by Functional and Leakage Tests applicable to a pump canister. A System Test is not required in this application.

2. Operational Test - Pump Element

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT THE TRANSFER OF FUEL INTO TANK 11 WITHOUT AIRCRAFT OVERBALANCE OCCURRING.

(2) Ensure that tank 11 contains at least 1,500 kg of fuel. Transfer fuel (Ref. 28-23-00, Adjustment/Test) or refuel (Ref. 12-11-28) as necessary.

(3) Ensure that all fuel management panel switches are
R at their normal ground settings (Ref. 28-00-00,
R Servicing).

(4) On the lower electrical services panel 6-214 (3CM), set the LIGHTS CTR switch to "TEST" and check that all captions on the fuel management panel are illuminated. Release the switch.

R (5) Set tank 9 INLET VALVES MAIN switch (LH or RH, as required), to "OPEN". Check that the associated

indicator display changes from bar-across-line to diagonal stripes then to bar-in-line.

B. Test

(1) Set tank 11 electric PUMPS switch (LH or RH, as required), to "ON". Check that the LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(2) Check, by recording the fuel quantity indicator readings, that the fuel flow rate from tank 11 to tank 9 is approximately 378 kg/min over a period of 3 min.

(3) Set the PUMP switch to "OFF".

R (4) Set tank 9 INLET VALVES MAIN switch to "SHUT", checking that the associated indicator display changes from bar-in-line to diagonal stripes then to bar-across-line.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test - Canister

A. Prepare

(1) Drain the tank (Ref. 28-25-00, Servicing).

R CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS
R (REF. 28-00-00, SERVICING - TECHNICAL
R PRECAUTIONS).

R (2) Drain the trim transfer pipe as follows:-

R (a) Position a clean container at the fuel
R jettison outlet. This will collect a small
R amount of fuel that will drain from the outlet
R when the master jettison valves are opened.

R (b) At the fuel management panel, set the JETTISON
R MASTER VALVES switches to "OPEN".

R (c) Set the TRIM PIPE DRAIN switch to "OPEN".

R NOTE: The SCAVENGE PUMP indicator will display
R ON as fuel drains into the scavenge tank.

R (d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

R (e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

R (f) Remove the container.

R (3) Release the fasteners and open panel 311 AB (forward) or panel 311 BB (rear) to gain access to the pump unit.

R (4) Remove the pump element (Ref. Removal/Installation).

B. Test

CAUTION: WET THE INLET SLEEVE SEAL WITH FUEL BEFORE TESTING.

(1) Manually operate the fuel inlet sleeve, the fuel outlet non-return valve and the relief valve (vapour vent). Check for full and free movement.

C. Conclusion

R (1) Carry out a Leakage Test of the canister (Ref. para.4.).

4. Leakage Test - Canister

A. Prepare

R (1) Position a clean container below the canister to collect fuel leakage.

R WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT TANK 11 TO BE REFUELLED WITHOUT AIRCRAFT OVERBALANCE OCCURRING. REFERENCE SHOULD BE MADE TO THE WEIGHT AND BALANCE MANUAL, BUT FOR MOST AIRCRAFT ZERO FUEL WEIGHTS AND ZERO FUEL CGs, TANKS 10, 1 and 4 WILL HAVE TO BE FULL AND ALL OTHER TANKS (EXCEPT 9 AND 11) WILL HAVE TO BE EMPTY.

R (2) Refuel the tank (Ref. 12-11-28), observing the loading limitations.

B. Test

(1) Check that the rate of fuel leakage past the fuel inlet sleeve and the relief valve (vapour vent) does not exceed 113 cc/min.

(2) Install the pump element (Ref. Removal/Installation).

C. Conclusion

(1) Carry out an Operational Test of the pump element (Ref. para.2.).

R (2) Fit and secure the access panel (Ref. 53-00-00,
R Removal/Installation).

ELECTRIC PUMP PRESSURE SWITCH (TANK 11) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pressure switches, one to each electrically operated fuel transfer pump, are mounted on the outside of the front wall of tank 11. The switches, which are connected to the pump outlets inside the tank, sense low pressure output from the pumps and give indication of this by illuminating captions on the fuel management panel in the flight compartment.

2. Pressure Switch

**ON A/C 001-004,
(Ref. Fig. 401)

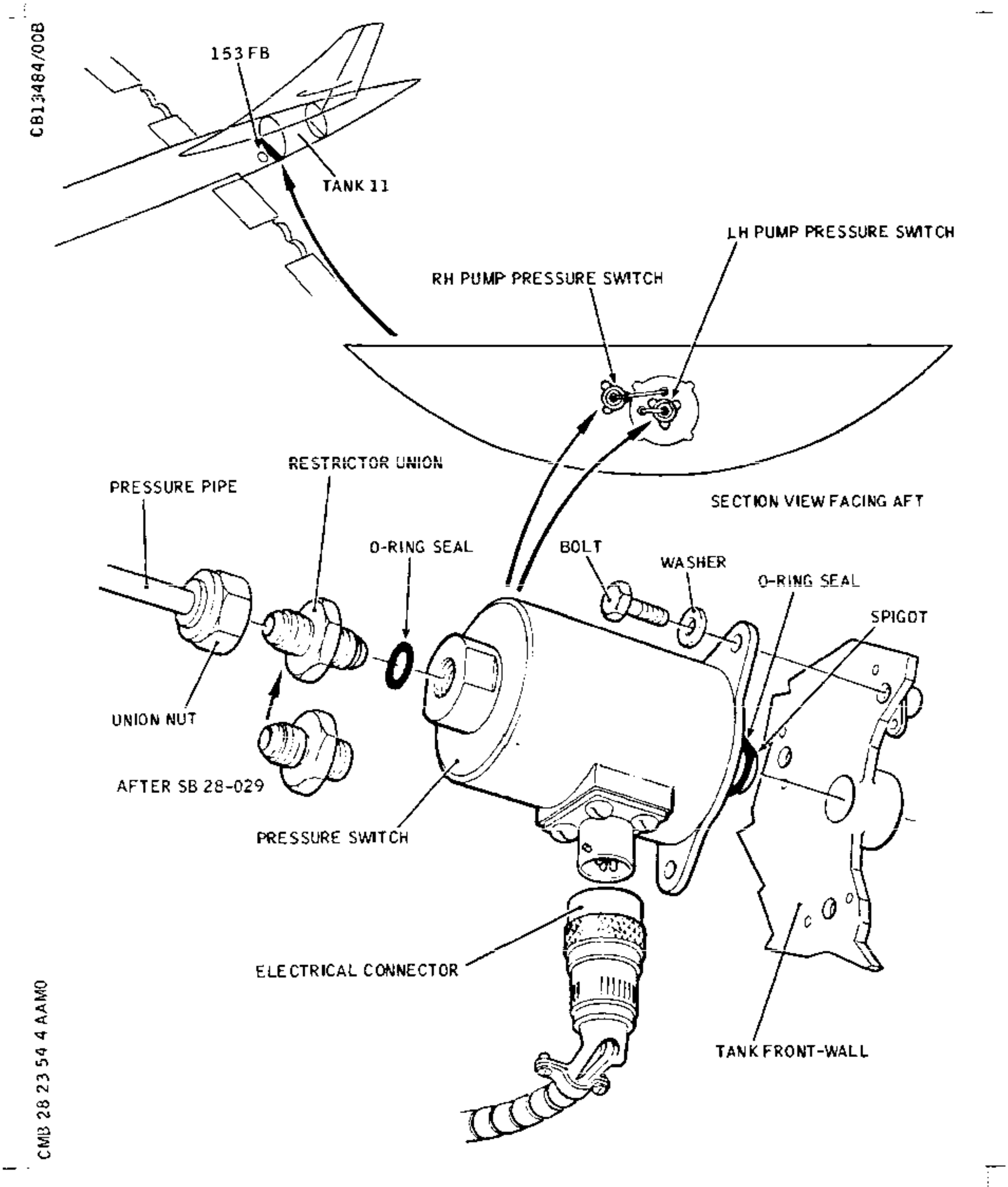
R **ON A/C 005-007,
(Ref. Fig. 402)

A. Equipment and Materials

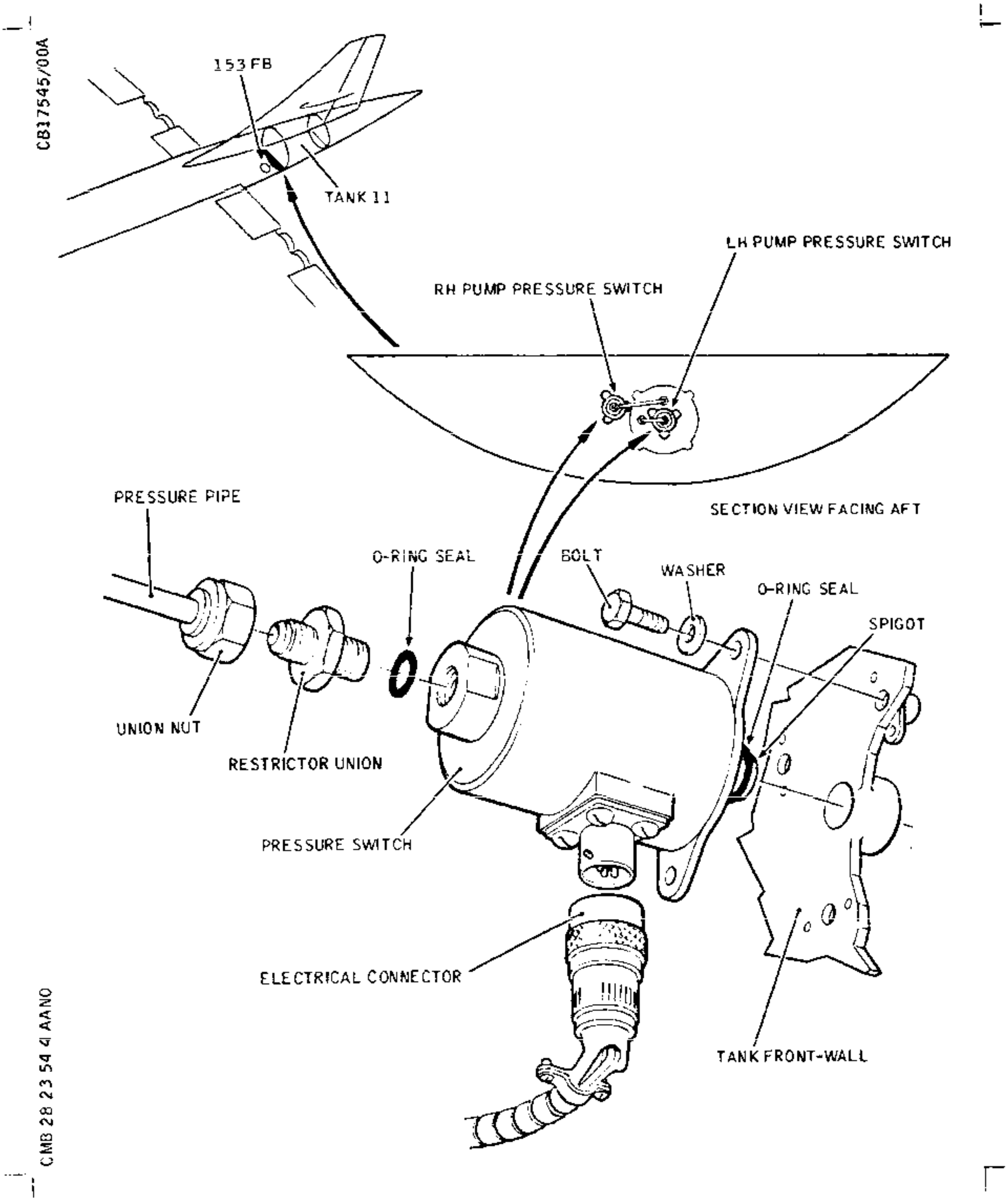
DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 107 to 117 lbf in (1.21 to 1.32 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.79 to 0.90 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.45 to 0.73 mdaN)	-

B. Prepare to Remove

(1) Ensure that the fuel management panel switches are in their usual ground positions (Ref. 28-00-00, Servicing). Place a placard on the panel warning that the positions of the switches must not be changed.



R Pump Pressure Switch - Installation
Figure 401



Pump Pressure Switch - Installation
Figure 402

R (2) Ensure that the tank fuel level is below the switch; transfer fuel (Ref. 28-00-00, Servicing), or defuel (Ref. 28-25-00, Servicing) as necessary; drain residual fuel in the associated pump canister (Ref. 28-23-53, Removal/Installation).

(3) Electrically isolate the appropriate pump control and indication circuits by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 RH PUMP SUP	13-215	Q1376	E16
TANK 11 RH PUMP IND	15-216	Q1389	C5
TANK 11 LH PUMP SUP	13-216	Q1375	F4
TANK 11 LH PUMP IND	15-215	Q1388	E21

(4) Remove the access panel 153 FB on the bottom surface of the rear fuselage in order to gain access to the pressure switches.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the pressure pipe from the pressure switch by unscrewing the union nut.

(3) Remove the attachment bolts and countersunk washers from the pressure switch; note the position of the special earthing bolt.

R (4) Withdraw the switch from the tank wall. Fit a suitable blank to the port at each end of the switch. If a replacement switch is to be fitted, remove and retain the restrictor union before blanking off the ports.

(5) Fit suitable blanks to the pressure pipe union nut and to the aperture in the tank wall.

D. Prepare to Install

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R NOTE: In operation (1) the restrictor union must be
R fitted with its smaller diameter bore in the
R pressure switch.

(1) If a replacement pressure switch is to be installed,
R fit the restrictor union removed from the original switch, using a new O-ring seal. Torque-tighten
R the union to between 107 and 117 lbf in (1.21 and 1.32 mdaN).

(2) Remove the blank from the pressure switch, then fit a new O-ring seal, lubricated with clean fuel, in the groove in the pressure switch spigot.

E. Install

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE EARTHING REQUIREMENTS OF THESE ITEMS ARE SATISFIED IN ACCORDANCE WITH 20-27-11.

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blank from the aperture in the tank wall and insert the pressure switch spigot into the aperture. Ensure that the O-ring seal is correctly located, then push the switch fully into position.

(3) Insert the attachment bolts through the countersunk washers, with the countersunk face of each washer toward the bolt head.

(4) Place the switch in position and secure it with the bolts, complete with washers; ensure that the special earthing bolt is in its correct position.

(5) Torque-tighten the attachment bolts to between 70 and 80 lbf in (0.79 and 0.90 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(6) Check that the electrical bonding is in accordance with 20-27-11.

(7) Remove the blank from the pressure pipe union nut, then connect the union nut to the pressure switch. Torque-tighten the union nut to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(8) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Refuel the tank (Ref. 12-11-28).

(3) Carry out an Operational Test of the pressure switch (Ref. Adjustment/Test) and, while the pump is running, check that there is no leakage from the pressure switch over a period of 5 min.

(4) Refit the access panel 153 FB.

(5) Remove the placard from the panel.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

ELECTRIC PUMP PRESSURE SWITCH (TANK 11) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises an Operational Test. Functional and System Tests are not required in this application.

2. Operational Test

A. Prepare

(1) Ensure that the fuel management panel switches are in their usual ground positions (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that the tank contains at least 1,000 kg of fuel, as shown on the fuel quantity indicator.

B. Test

(1) Set the associated pump control switch to "ON". Check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up.

(2) Simulate a failure of the pump by tripping its associated control circuit breaker. Check that the pump LOW PRESS caption is illuminated.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH PUMP CONT	15-216	Q187	D3
TANK 11 RH PUMP CONT	15-215	Q188	D23

(3) Reset the circuit breaker and check that the LOW PRESS caption is extinguished as pump pressure builds up.

C. Conclusion

(1) Set the pump switch to "OFF".

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

PRESSURE HOLDING NON-RETURN VALVE (TANK 11) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig.401)

Each electrically-driven pump in tank 11 has a spring-loaded non-return valve in its outlet that acts as a pressure holding valve and prevents reverse fuel flow when the pump is inoperative.

To gain access to a non-return valve the tank must be drained and entered.

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2. Non-return Valve

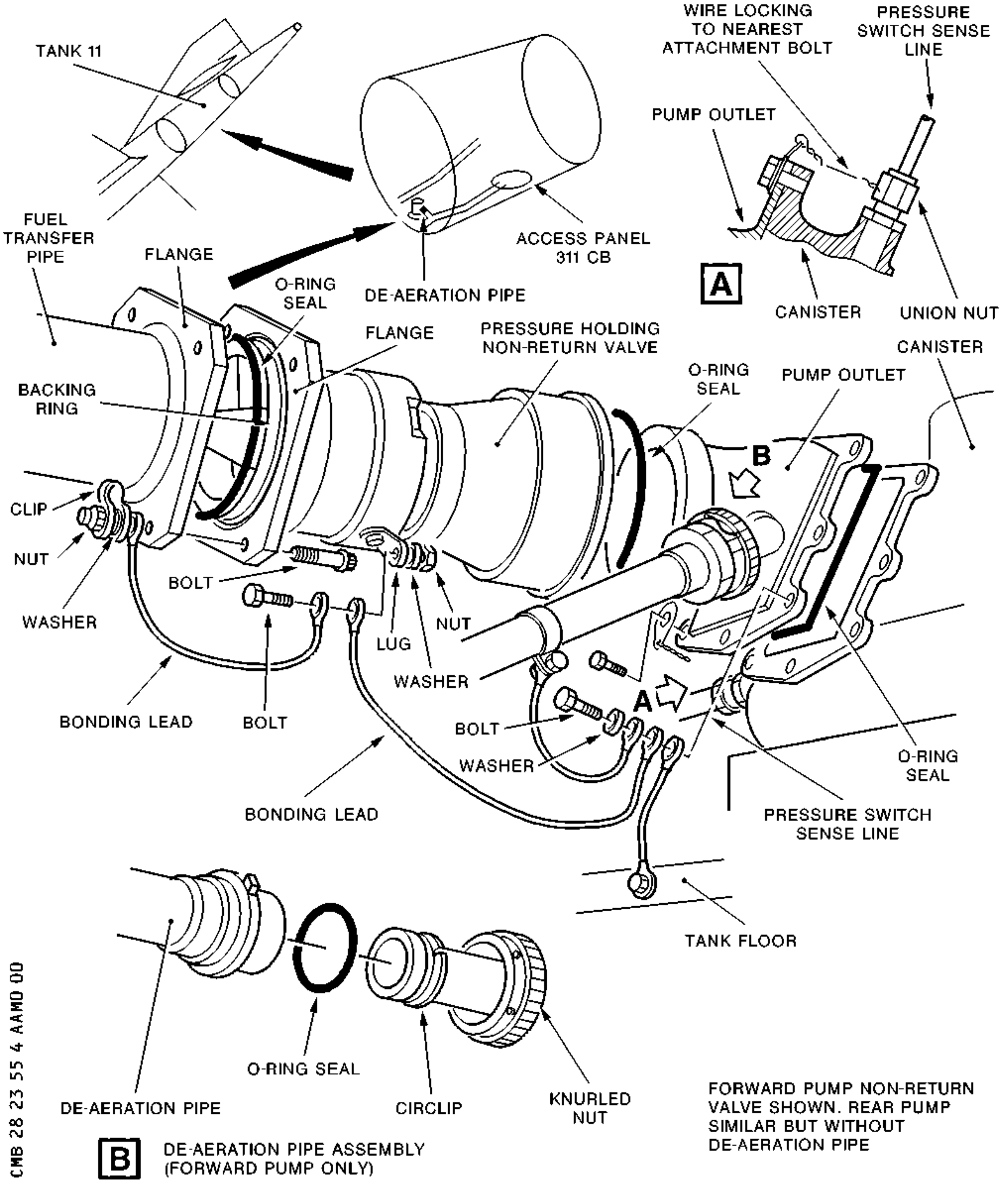
A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-
Torque spanner, 74 to 80 lbf in (0.836 to 0.904 mdaN)	-
Circuit breaker safety clips	-
Clean container, 10 gal (45 l), for fuel drainage	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard at the panel warning that the positions of the switches must not be altered.

(2) Electrically isolate the associated pump supply and indication circuits by tripping the appropriate circuit breakers. Fit safety clips.



Pressure Holding Non-return Valve (Tank 11) - Installation
Figure 401

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 11 LH PUMP SUP (forward pump)	13-216	Q1375	F 4
TANK 11 LH PUMP IND (forward pump)	15-215	Q1388	E21
TANK 11 RH PUMP SUP (rear pump)	13-215	Q1376	E16
TANK 11 RH PUMP IND (rear pump)	15-216	Q1389	C 5

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(3) Defuel and drain the tank (Ref. 28-25-00, Servicing).

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(4) Drain the trim transfer pipes as follows:

(a) Position the 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(f) Remove the container.

(5) Remove the tank access panel 311 CB and prepare the tank for entry (Ref. 28-10-00, Servicing.

(6) Enter the tank to gain access to the non-return valve.

C. Remove

(1) Remove the wire-locking from the bolt heads and clips on the fuel transfer pipe and non-return valve flanged joint.

(2) Remove the four bolts, together with the clips, washers, nuts and bonding lead.

(3) If a forward non-return valve is being removed, disconnect the de-aeration pipe from the pump outlet by unscrewing the knurled nut and gently withdrawing the pipe into the ducting in order to allow sufficient clearance between the pipe and the pump outlet.

(4) Remove the wire-locking from the bolts securing the pump outlet to the canister and also the wire-locking from the pressure switch sense line union nut.

(5) Support the non-return valve and remove the eight bolts and washers securing the pump outlet to the canister, noting the position of the special bonding bolt, which has a dimpled head and secures three bonding leads (forward pump) or two bonding leads (rear pump).

(6) Slide the pump outlet approximately 0.25 in (6.35 mm) into the non-return valve housing and remove the non-return valve together with the pump outlet. Withdraw and separate the pump outlet from the non-return valve.

NOTE: In the flanged joint of the valve there is a loose-fitting backing ring. The backing ring and O-ring seal must be retained by finger pressure during removal of the non-return valve.

(7) If a replacement non-return valve is to be fitted, remove the bolt, washer and nut which secure the two bonding leads to the non-return valve body.

(8) Remove and discard the O-ring seals from the grooves in the pump outlet, the non-return valve outlet and the de-aeration pipeline (forward pump only).

(9) Remove the flange, with the backing ring and seals, from the non-return valve. Discard the seals.

(10) Fit suitable blanks to the canister outlet port, the pump outlet ports, the non-return valve ports, the fuel transfer pipe and the de-aeration pipe and coupling (forward pump only).

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D. Install

(1) Comply with the fuel and electrical safety precautions.

(2) Remove the blanks from the pump outlet, the non-return valve, the canister outlet port, and, in the case of a forward pump, the de-aeration pipe connections.

(3) Ensure that all joint faces and pipe connections are clean and undamaged.

(4) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the downstream end of the pump outlet.

(5) Insert the pump outlet fully into the non-return valve to form one unit.

(6) Assemble the flange to the non-return valve as follows:

(a) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the groove in the flange body.

(b) Fit the flange over the non-return valve.

(c) Fit the backing ring, with its narrow end pointing downstream, to the flange. Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the cut-back area on the flange.

(d) Retain the backing ring and O-ring seal by finger pressure.

(7) Fit new O-ring seals, lubricated in accordance with 20-23-11, one between the canister and pump outlet and one in the groove in the de-aeration branch pipe (forward pump only).

<u>CAUTION</u>: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THE BONDING REQUIREMENTS OF THESE ITEMS ARE SATISFIED IN ACCORDANCE WITH 20-27-11.

(8) Place the unit in position and secure it to the canister with the eight bolts and washers, ensuring that the special earthing bolt and the three bonding leads (forward pump) or two bonding leads (rear pump) are correctly positioned. Torque-tighten each bolt to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

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(9) Wire-lock the bolt heads in pairs in accordance with 20-21-13. Wire-lock the pressure switch sense line union nut to the nearest attachment bolt in accordance with 20-21-13.

(10) Secure the non-return valve outlet to the fuel transfer pipe with the four bolts, washers, clips and nuts, ensuring that the bonding lead is correctly positioned. Torque-tighten the bolts to between 74 and 80 lbf in (0.836 and 0.904 mdaN).

(11) Wire-lock the bolt heads in pairs and wire-lock the clips in pairs in accordance with 20-21-13.

(12) If installing a replacement non-return valve, position the appropriate bonding leads on the lug on the non-return valve and secure them with the bolt, washer and nut.

(13) If a forward pump non-return valve is being installed, secure the de-aeration pipe to the pump outlet by means of the knurled nut and tighten the nut in accordance with 20-23-21.

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E. Conclusion

R (1) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (2) Ensure that the mating surfaces of the tank and tank access panel are clean and undamaged. Fit and secure the panel to the tank as detailed in 53-00-00, Removal/Installation.

R (3) Remove the warning placard.

R (4) Remove the safety clips and reset the circuit breakers tripped before removal.

R (5) Carry out an Operational Test of the non-return valve (Ref. Adjustment/Test). During this test check that there is no leakage of fuel past the tank access panel.

PRESSURE HOLDING NON-RETURN VALVE (TANK 11) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

A spring-loaded non-return valve at the outlet of each electrically-driven pump in tank 11 acts as a pressure holding valve to prevent reverse fuel flow when the pump is inoperative.

It also prevents gravity fuel flow from the tank when the pump is not in use.

This topic comprises an Operational Test to prove these functions and also to test the rate of fuel flow through the valve when the pump is operating. Functional and System Tests are not required in this application.

Controls and indicators required for the test are on the fuel management panel, at the third crew member's (3CM) position.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that tank 9 contains approximately 5,000 kg of fuel.

WARNING: ENSURE THAT EXISTING FUEL LOADING WILL PERMIT TANK 11 TO BE REFUELLED WITHOUT AIRCRAFT OVERBALANCE OCCURRING. REFERENCE SHOULD BE MADE TO THE WEIGHT AND BALANCE MANUAL, BUT FOR MOST AIRCRAFT ZERO FUEL WEIGHTS AND ZERO FUEL CGs, TANKS 10, 1 AND 4 WILL HAVE TO BE FULL AND ALL OTHER TANKS (EXCEPT 9 AND 11) WILL HAVE TO BE EMPTY.

R (3) Refuel tank 11 (Ref. 12-11-28) to 5,500 kg.

(4) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

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(5) On the lower electrical services panel 6-214 (3CM) press the LIGHTS CTR switch to "TEST" and check that the LOW PRESS captions on the fuel management panel above tanks 9 and 11 PUMP switches are illuminated. Release the switch and check that the captions are extinguished.

R (6) Set tank 9 INLET VALVES MAIN switch (LH or RH, as required) to "OPEN". Check that the associated indicator display changes from bar-across-line to diagonal stripes, then to bar-in-line.

NOTE: For testing the forward non-return valve, open the LH tank 9 inlet valve; for testing the rear non-return valve, open the RH tank 9 inlet valve.

B. Test

(1) Check, by reference to the fuel quantity indicators (FQIs), that there is no gravity fuel flow from tank 11 to tank 9 over a minimum period of 15 min.

(2) Set the tank 11 electric PUMP switch (LH or RH, as appropriate) to "ON". Check that the associated LOW
R PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(3) Check, by recording the FQI readings, that the fuel flow rate from tank 11 to tank 9 is approximately 378 kg/min over a minimum period of 3 min.

(4) Set the PUMP switch to "OFF".

(5) Set tank 9 INLET VALVES MAIN switch to "SHUT", checking that the associated indicator display changes from bar-in-line to diagonal stripes, then to bar-across-line.

(6) Set the tank 9 PUMP switch (LH or RH, as appropriate) to "ON". Check that the associated LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

(7) Check, by reference to the FQI, that no fuel is transferred to tank 11 over a minimum period of 15 min.

(8) Set the PUMP switch to "OFF".

C. Conclusion

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(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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LOAD LIMIT CONTROL SELECTOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The required tank fuel quantities for auto trim transfer are pre-selected by means of two load limit selectors mounted on the fuel management panel.

One selector is for the combined contents of tanks 9 and 10, and the other is for the contents of tank 11.

The two selectors are not interchangeable because the full-scale digital displays are different.

2. Load Limit Control Selector (Ref. Fig. 401)

A. Prepare

CAUTION: ELECTROLUMINESCENT (EL) PANELS ARE VULNERABLE TO DAMAGE BY SCRATCHING AND CRACKING. ENSURE THAT TOOLS USED IN THE FOLLOWING OPERATIONS DO NOT DAMAGE THE POLISHED WALLS OF THE EL PANELS.

(1) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

(2) Release the fuel management panel quick-release fasteners, press in the spring retaining clip at each side of the panel and lower the panel on its hinges.

B. Remove

(1) Disconnect the electrical connectors from the selector.

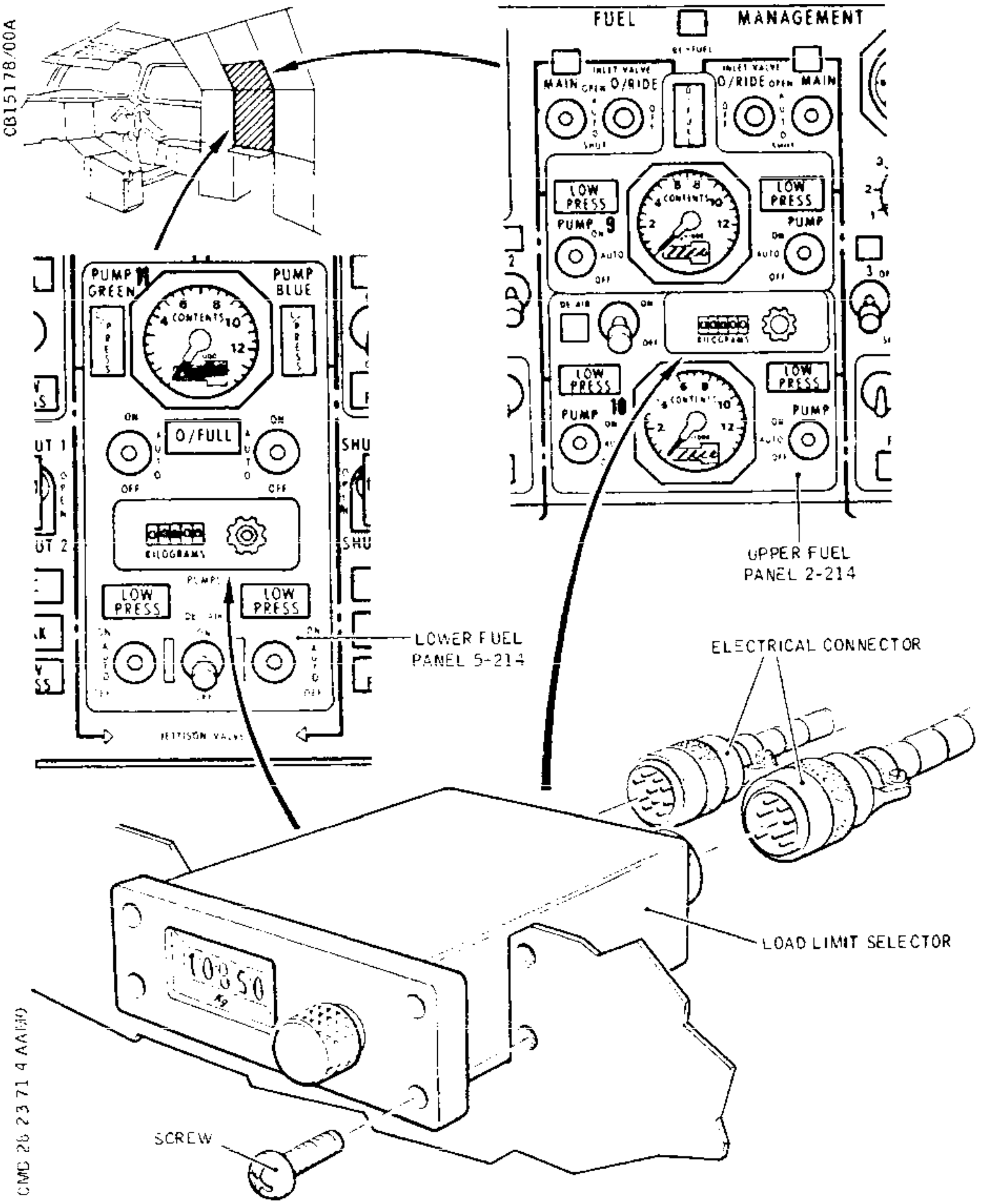
(2) Remove the four screws at the front of the panel and withdraw the selector.

C. Install

(1) Comply with the electrical safety precautions.

(2) Attach the selector to the panel with the screws.

(3) Connect the electrical connectors to the selector, ensuring that the mating surfaces are clean and undamaged.



- Load Limit Control Selector - Installation
Figure 401

D. Conclusion

(1) Close the appropriate panel and secure it with the quick-release fasteners.

(2) Cancel the electrical safety precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(3) Check the operation of the selector by carrying out an Operational Test (Ref. Adjustment/Test).

Printed in England

LOAD LIMIT CONTROL SELECTOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The trim tank contents are pre-selected on two load limit selectors, one for tanks 9 and 10 and the other for tank 11.

When the selected fuel load is reached, the auto trim transfer will close the inlet valves of tank 9 or 11, or switch off the associated transfer pumps.

The setting knob of the selector operates two potentiometers simultaneously, one for each load limit channel. A caption, inscribed LLC, on the fuel management panel, is illuminated yellow when a disparity exists between the signals from the two channels. This caption should not be illuminated at any time during the test procedures.

This topic comprises Operational Tests applicable to each load limit selector in the trim system. Functional and System Tests are not applicable.

2. Operational Test (Tanks 9 + 10 Selector)

A. Prepare

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft attitude is within the nominal ground envelope.

(2) Refuel tank 9 to 4,000 kg and tanks 1, 4 and 10 to 'high level' quantities (Ref. 12-11-28).

WARNING: OBSERVE THE AIRCRAFT OVERBALANCE PRECAUTIONS DETAILED IN 28-00-00, SERVICING, WHEN TRANSFERRING FUEL.

(3) Ensure that tank 11 contains approximately 2,000 kg of fuel. Transfer fuel (Ref. 28-00-00, Servicing) or refuel (Ref. 12-11-28) as necessary.

(4) Make available electrical ground power as detailed in 24-41-00.

(5) Check that all fuel management panel switches are

at their normal ground settings (Ref. 28-00-00, Servicing).

(6) Check that the magnetic indicators, for all valves associated with the trim galleries, display a shut indication.

(7) Check that all INLET VALVE MAIN and trim PUMP switches are set to AUTO and the INLET VALVE O/RIDE switches are set to OFF.

(8) Ensure that the refuel control panel door is shut and the FUEL FWD TRANS override switch, located on the pilots' roof panel, is set rearward and engaged in its guard.

(9) Pressurize the green and blue hydraulic systems, using the ground pressurizing system (Ref. 29-23-00).

B. Test

(1) Pull out and rotate the setting knob throughout the full range (0-25,000 for tank 9 + 10), checking that the digital rollers move freely and the reading is in steps of 10 kg.

(2) Release the knob and check that it springs back to the normal position where it can free-wheel.

(3) Add the fuel quantity indicator reading of tank 10 to the 4,000 kg of tank 9 and set this, plus a further 1,500 kg, on the tank 9 + 10 selector.

(4) Set the tank 11 selector to zero.

(5) Set the TRIM TRANS AUTO MASTER switch to "FORWARD" and check that transfer from tank 11 to tank 9 commences.

(6) Check that the fuel quantity in tank 9, when its inlet valves automatically shut, is within 200 kg of 5,500 kg.

(7) Set the TRIM TRANS AUTO MASTER switch to "OFF".

C. Conclusion

(1) Switch off the hydraulic ground pressurizing system (Ref. 29-23-00).

(2) Switch off and disconnect electrical ground power

as detailed in 24-41-00.

3. Operational Test (Tank 11 Selector)

A. Prepare

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft attitude is within the nominal ground envelope.

(2) Ensure that tank 11 is empty. Transfer fuel or defuel (Ref. 28-25-00) if necessary.

(3) Refuel tank 9 to 4,000 kg and tanks 1, 4 and 10 to 'high level' quantities (Ref. 12-11-28).

(4) Make available electrical ground power as detailed in 24-41-00.

(5) Check that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(6) Check that the magnetic indicators, for all valves associated with the trim galleries, display a shut indication.

(7) Check that all INLET VALVE MAIN and trim PUMP switches are set to AUTO and the INLET VALVE O/RIDE switches are set to OFF.

(8) Ensure that the refuel control panel door is shut and the FUEL FWD TRANS override switch, located on the pilots' roof panel, is set rearward and engaged in its guard.

B. Test

(1) Pull out and rotate the setting knob throughout the full range (0-14,500 for tank 11) checking that the digital rollers move freely and the reading is in steps of 10 kg.

(2) Release the knob and check that it springs back to the normal position where it can free-wheel.

(3) Set tank 11 selector to 2,000 kg.

(4) Set tank 9 + 10 selector to zero.

WARNING: ENSURE THAT THE FOLLOWING REARWARD FUEL TRANSFER CAN BE CARRIED OUT WITHOUT AIRCRAFT OVERBALANCE OCCURRING (REF. 28-00-00, SERVICING).

(5) Set the TRIM TRANS AUTO MASTER switch to "REARWARD" and check that transfer from tank 9 to tank 11 commences.

(6) Check that the fuel quantity in tank 11, when its inlet valves automatically shut, is within 200 kg of 2,000 kg.

WARNING: IF THE INLET VALVES DO NOT SHUT AUTOMATICALLY, STOP FUEL TRANSFER IMMEDIATELY AND INVESTIGATE.

(7) Set the TRIM TRANS AUTO MASTER switch to "OFF".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

**ON A/C 001-005,

FUEL TRIM PUMP START CONTROL UNIT - REMOVAL/INSTALLATION

After SB 28-048

R **ON A/C 006-007,

FUEL TRIM PUMP START CONTROL UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE AIRCRAFT GROUND STABILITY PRECAUTIONS DETAILED IN 12-00-10.

1. General

The fuel trim pump start control units, one each for tanks 9 and 10 trim pumps, are mounted in the forward underfloor racking in zone 123. The control units are each attached to the centre structure panel 12-123 by two screws and a spigot.

This topic contains the removal/installation procedures for a single control unit.

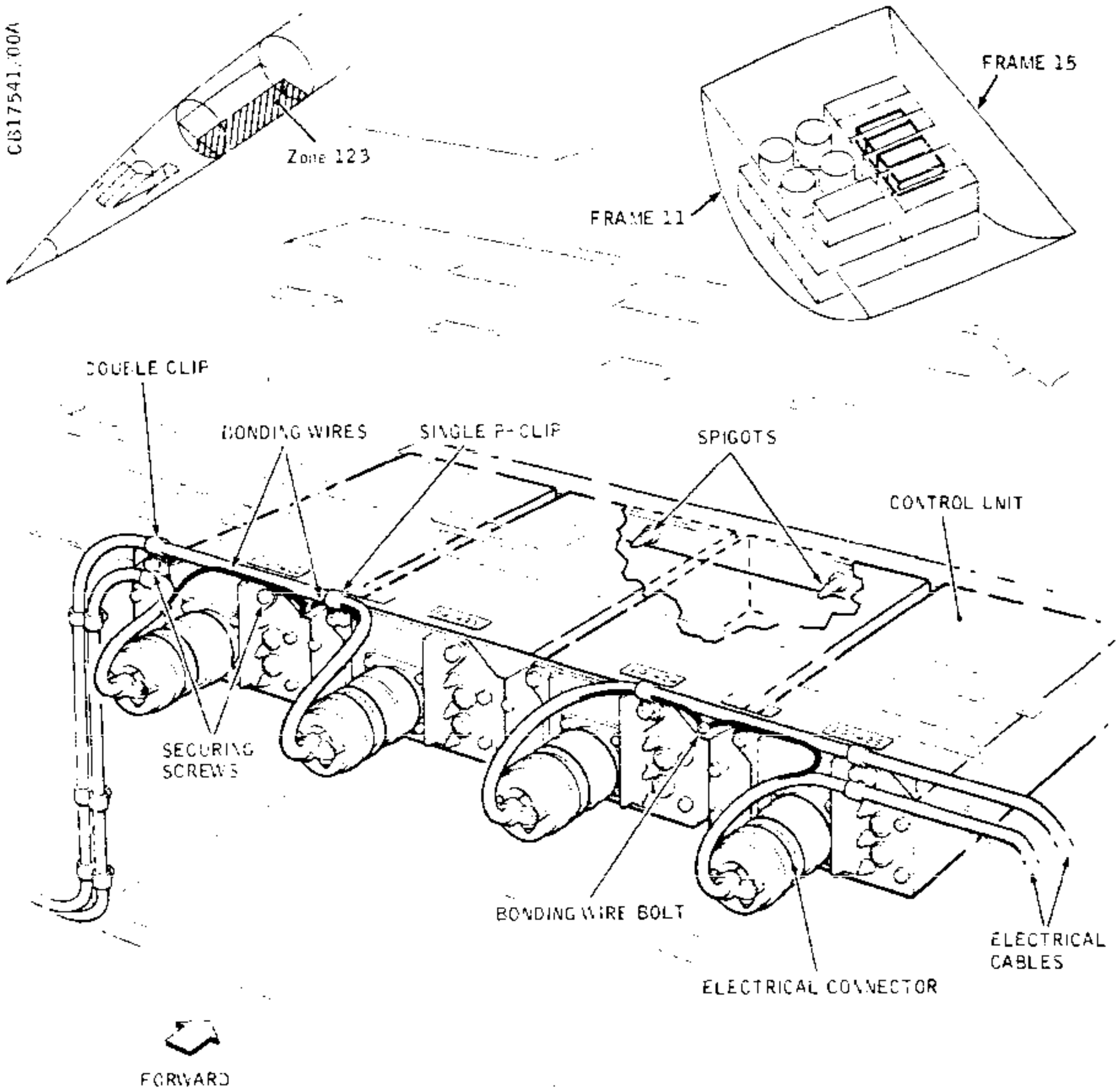
2. Pump Start Control Unit (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 35 to 44 lbf in (0.40 to 0.50 mdaN)	-
Torque spanner, 21 to 24 lbf in (0.240 to 0.271 mdaN)	-

B. Prepare to Remove

(1) Electrically isolate the control unit by tripping the appropriate circuit breakers; fit safety clips.



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PUMP TANK NO.	9LH	10LH	9 RH	10 RH
ELECT IDENT.	1Q1424	1Q1425	2Q1424	2Q1425
CONTROL UNIT IDENT AND ASSOCIATED PUMPS				

\- Pump Start Control Unit - Installation
Figure 401

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 LH PUMP SUP	14-215	1Q189	C17
TANK 9 LH PUMP CONT	14-215	1Q181	D15
TANK 9 RH PUMP SUP	13-216	2Q189	B1
TANK 9 RH PUMP CONT	13-216	2Q181	E3
TANK 10 LH PUMP SUP	14-216	1Q190	B1
TANK 10 LH PUMP CONT	14-216	1Q184	C3
TANK 10 RH PUMP SUP	13-215	2Q190	C19
TANK 10 RH PUMP CONT	13-215	2Q184	B16

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing). Place a placard on the fuel management panel warning that the position of the switches must not be changed.

(3) Open the forward service compartment door, 123 BB.

C. Remove

(1) Remove and retain the bolt, nut and washer that secure the bonding wires.

(2) Remove and retain the screw that secures the electrical cable P-clip.

(3) Disconnect the electrical connector from the control unit. Stow the connector and cable in a secure position.

(4) Support the control unit and remove the remaining securing screw.

(5) Gently slide the control unit rearward away from its spigot.

(6) Remove the control unit.

D. Install

(1) Comply with the electrical safety precautions.

(2) Ensure that the mounting attachments, namely, the anchor nuts and spigot, are clean and free from damage.

(3) Gently slide the control unit onto its spigot and temporarily fit the securing screws.

(4) Connect the electrical connector to the control unit, ensuring that the mating surfaces are clean and undamaged.

(5) Refit the electrical cable P-clip to the control unit securing screw.

(6) Torque-tighten the control unit securing screws to between 35 and 44 lbf in (0.40 to 0.50 mdaN).

(7) Refit the bonding wire, using the bolt, washer and nut. Torque-tighten the bolt to between 21 and 24 lbf in (0.240 to 0.271 mdaN).

(8) Carry out a bonding check of the installed control unit (Ref. 20-27-11).

E. Conclusion

(1) Remove the warning placard and reset the circuit breakers previously tripped.

(2) Carry out a Functional Test (Ref. Adjustment/Test).

(3) Close and secure the service compartment door, 123 BB (Ref. 52-41-11).

**ON A/C 001-005,

FUEL TRIM PUMP START CONTROL UNIT - ADJUSTMENT/TEST

After SB 28-048

R **ON A/C 006-007,

FUEL TRIM PUMP START CONTROL UNIT - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE AIRCRAFT GROUND STABILITY PRECAUTIONS DETAILED IN 12-00-10.

1. General

The trim pump start control units control the average acceleration, of the trim pumps in tanks 9 and 10, uniformly over a 5 s start period, to prevent transient high fuel pressure in the main trim transfer pipes.

The control units, one for each pump, are in the forward underfloor racking in zone 123, in the centre structure panel 12-123. They are identified by their electrical identifier numbers, as follows:-

Tank 9 LH pump start unit - 1Q1424

Tank 10 LH pump start unit - 1Q1425

Tank 9 RH pump start unit - 2Q1424

Tank 10 RH pump start unit - 2Q1425

Indicators on the front panel of the unit comprise three neon lamps, identified A, B and C, and two light-emitting diodes (LEDs), identified 5 and 6.

This topic details an Operational Test and a Functional Test. The Operational Test is carried out at the fuel management panel and uses the latching facility of the T/O CG toggle switch (Ref. 28-44-00), on panel 1-214, to check the delay imposed by the control unit before the trim pumps contactors are energized. The Functional Test checks the operation of the control unit by the indications on its front panel.

2. Operational Test

NOTE: This test uses a switching sequence for a pair of pump switches (tank 9 LH and RH and/or tank 10 LH and RH) so that the delayed energizing of the trim pump contactors by the control units may be confirmed by the resetting of the T/O CG switch from 54% to NORM. The time delay is normally 5 s, but if the time delay is 6 s or 0 s a fault in the control unit is indicated and must be rectified.

A. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the tank associated with the pump start control unit under test contains not less than 1,000 kg of fuel. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing), as required.

B. Test

CAUTION: A TRIM PUMP MUST NOT BE OPERATED MORE THAN 5 TIMES IN THE FIRST 5 min OF ANY 15 min PERIOD.

(1) Check tank 9 LH start control unit.

(a) On panel 1-214, set the T/O CG toggle switch to "54%". Ensure that the switch is 'latched' in this position.

(b) Set tank 9 RH PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated and then extinguished.

(c) Wait 6 s after switching the RH pump on and then set tank 9 LH PUMP switch to "ON". Check that -

c1) the associated LOW PRESS caption is illuminated and then extinguished, and

c2) after 5 s the T/O CG switch resets to NORM.

(d) Set tanks 9 LH and RH PUMP switches to "AUTO".

(2) Check tank 9 RH start control unit.

(a) On panel 1-214, set the T/O CG toggle switch to "54%". Ensure that the switch is 'latched' in this position.

(b) Set tank 9 LH PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated and then extinguished.

(c) Wait 6 s after switching the LH pump on and then set tank 9 RH PUMP switch to "ON". Check that -

c1) the associated LOW PRESS caption is illuminated and then extinguished, and

c2) after 5 s the T/O CG switch resets to NORM.

(d) Set tanks 9 LH and RH PUMP switches to "AUTO".

(3) Check tank 10 LH start control unit.

(a) On panel 1-214, set the T/O CG toggle switch to "54%". Ensure that the switch is 'latched' in this position.

(b) Set tank 10 RH PUMP switch to "ON". Check that the associated LOW PRESS caption is illuminated and then extinguished.

(c) Wait 6 s after switching the RH pump on and then set tank 10 LH PUMP switch to "ON". Check that -

c1) the associated LOW PRESS caption is illuminated and then extinguished, and

c2) after 5 s the T/O CG switch resets to NORM.

(d) Set tanks 10 LH and RH PUMP switches to "AUTO".

(4) Check tank 10 RH start control unit.

(a) On panel 1-214, set the T/O CG toggle switch to "54%". Ensure that the switch is 'latched' in this position.

(b) Set tank 10 LH PUMP switch to "ON". Check

that the associated LOW PRESS caption is illuminated and then extinguished.

(c) Wait 6 s after switching the LH pump on and then set tank 10 RH PUMP switch to "ON". Check that -

c1) the associated LOW PRESS caption is illuminated and then extinguished, and

c2) after 5 s the T/O CG switch resets to NORM.

(d) Set tanks 10 LH and RH PUMP switches to "AUTO".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Suitable communications equipment, service compartment to flight compartment	-
Stopwatch	-

B. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that the tank associated with the pump start control unit under test contains not less than 1,000 kg of fuel. Refuel (Ref. 12-11-28) or transfer fuel (Ref. 28-00-00, Servicing), as required.

(4) Open the forward service compartment door 123 BB and

END OF THIS SECTION

NEXT

REFUEL - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

The trim transfer pipes, together with additional pipes and equipment, are used to refuel the aircraft. To form the refuelling system, each trim transfer pipe is connected to a refuel control unit (RCU), through which fuel is delivered to the aircraft and, through refuel tank inlet valves and branch pipes, to the fuel tanks. The left-hand RCU supplies tanks 1, 2, 5, 5A, 6, 9 and 11; the right-hand RCU supplies tanks 3, 4, 7, 7A, 8 and 10.

Each RCU has two self-sealing couplings to allow twin supplies of fuel into each trim transfer pipe, and an isolating valve which is manually operated by means of a control handle on the unit. A solenoid-controlled valve, within each unit, provides automatic shut-off action to protect the system under certain failure conditions.

Refuel protection pressure switches, mounted underneath tanks 5 and 8, detect any excessive fuel pressure in the trim transfer pipes during refuelling and initiate automatic shut-off of the associated RCU.

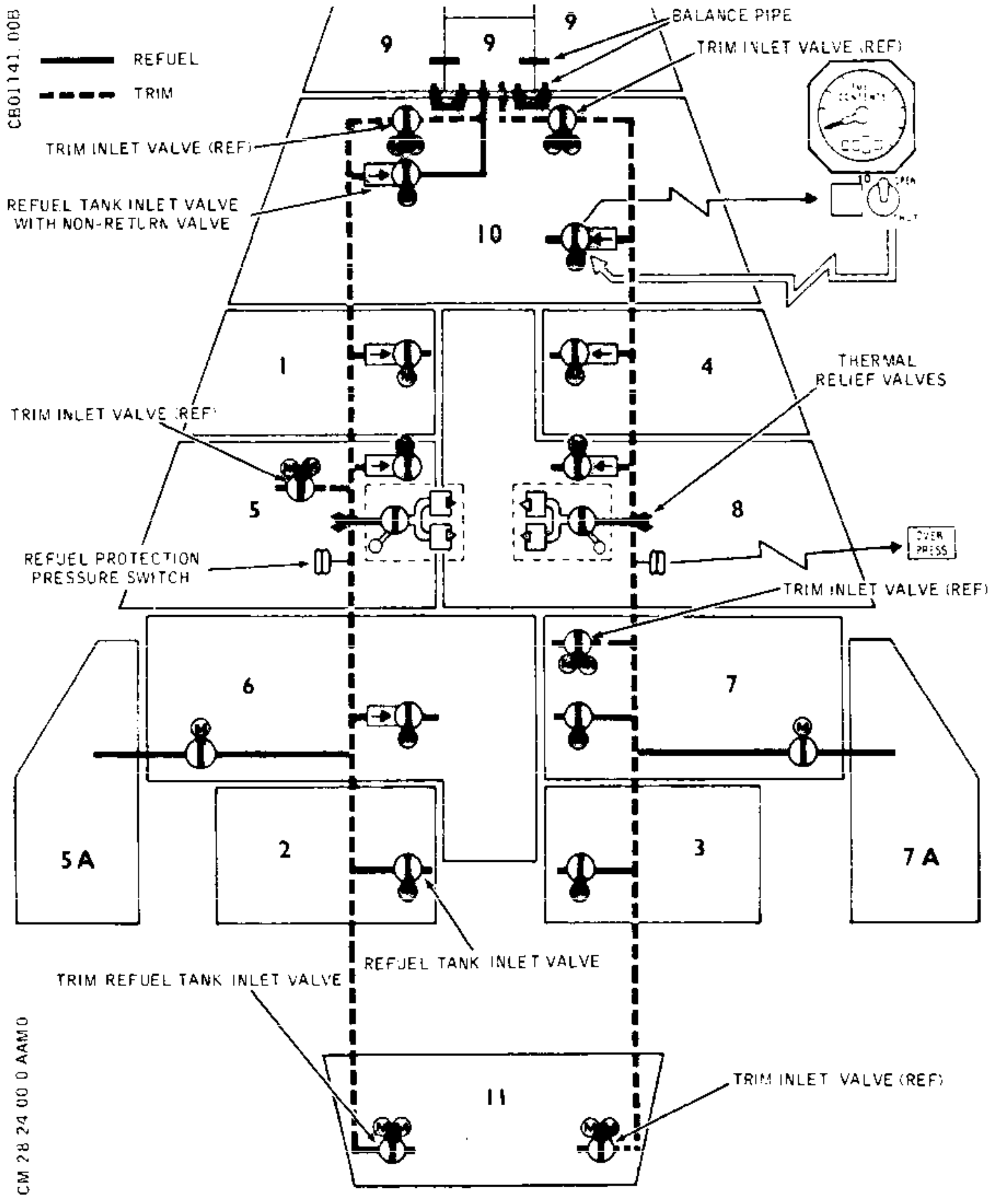
The refuel tank inlet valves are so installed that the fuelling of each tank is controlled by an individual valve. Non-return valves are incorporated in the inlet valves serving the forward tanks to prevent gravity flow out of the tanks and possible aircraft overbalance if a valve is inadvertently opened when the aircraft is on the ground.

Four thermal relief valves are fitted, two in each refuelling T-pipe above the RCUs. The valves are provided to relieve fuel pressure, caused by thermal expansion, in the trim transfer pipes when all other valves are closed. The thermal relief valves are normally closed by spring pressure and opened by fuel pressure acting against the spring, to allow a small fuel bleed into tanks 5 and 8.

The various controls and indicators for the refuel system are on the refuel control panel in the right-hand underwing fairing, forward of the main landing gear bay.

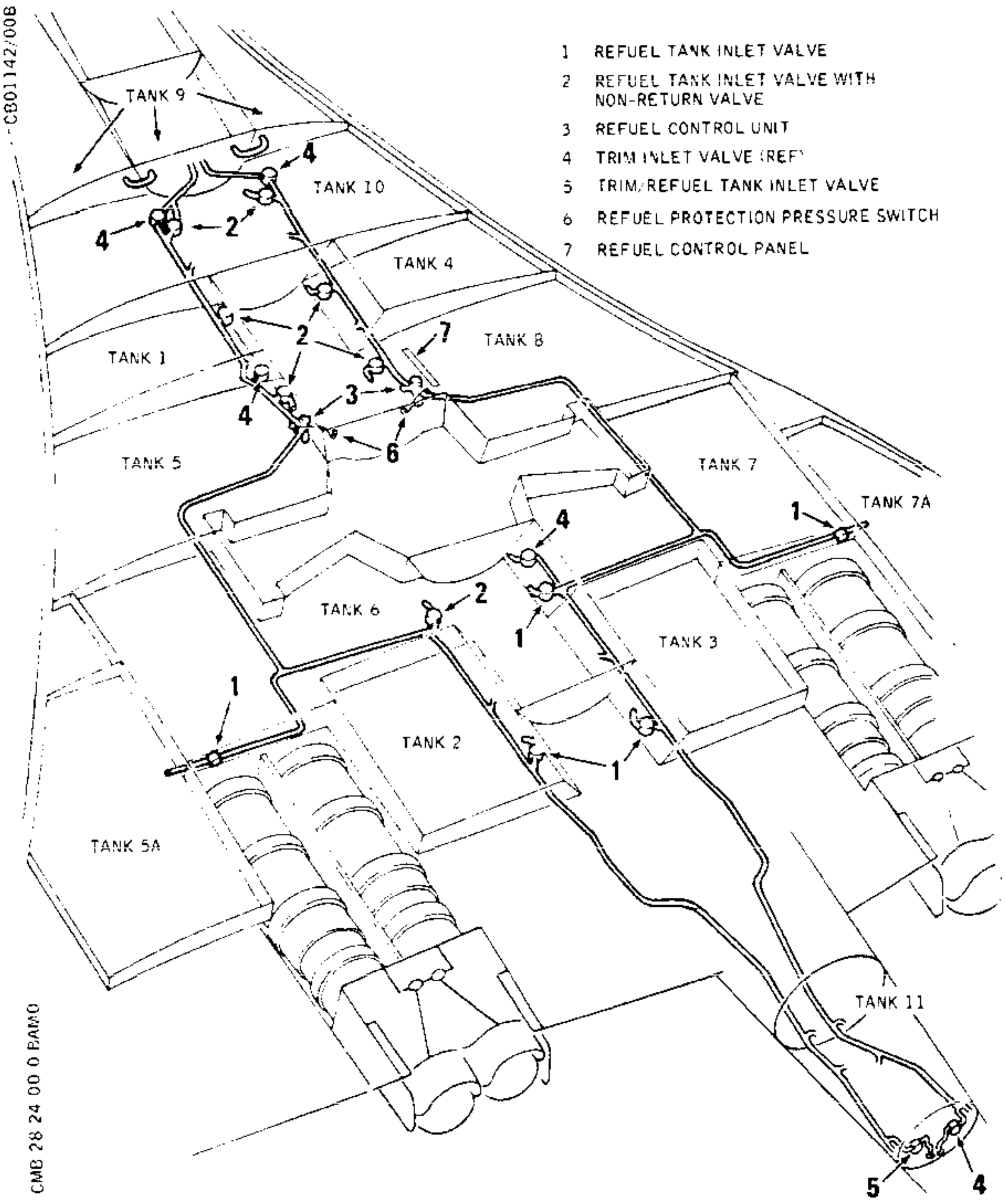
2. Refuel Control Unit (Ref. Fig. 003)

The two RCUs control fuel delivery to the trim transfer pipes during refuelling. Access to the units is through hinged doors in the underwing fairings below tanks 5 and

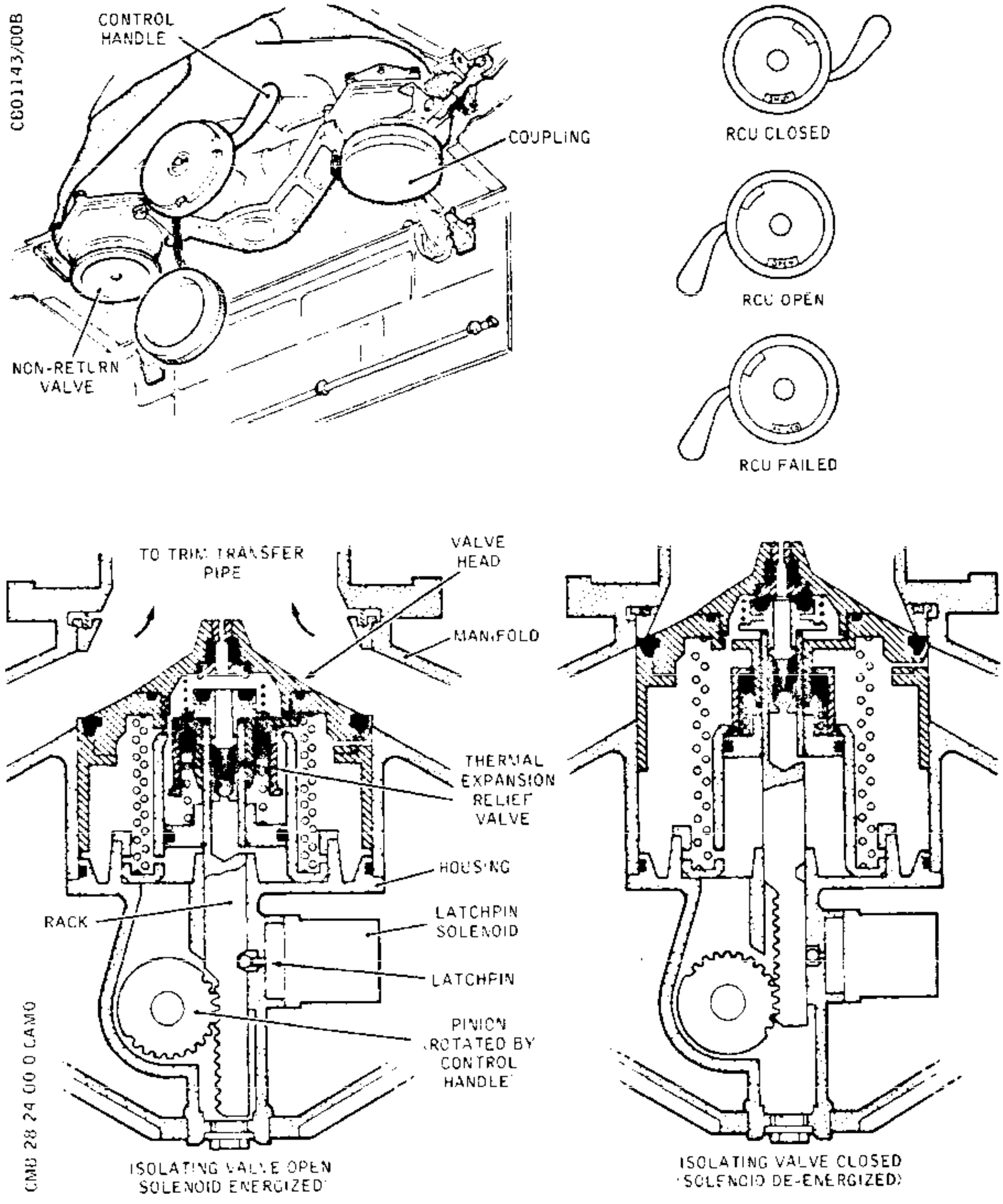


Refuel System - Schematic
Figure 001

R



R - Refuel System - Component Location
Figure 002



R Refuel Control Unit
Figure 003

8. The units are supported in the aircraft by mounting attachments next to the couplings and by a locking ring at the connection to the trim transfer pipe. The trim transfer pipe must be drained before an RCU is removed.

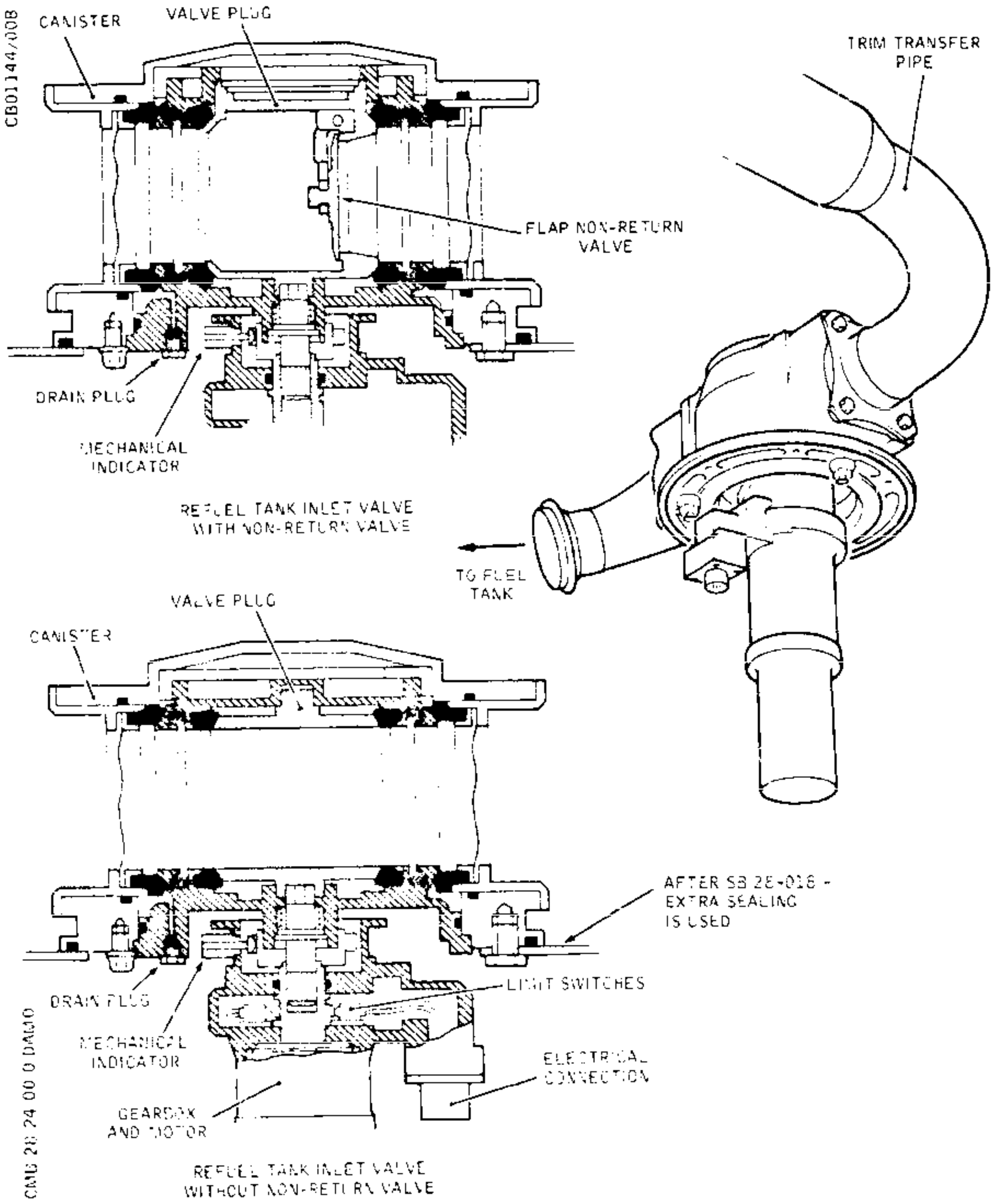
Each unit comprises two quick-release, self-sealing couplings, an isolating valve, a manifold and a control handle. The isolating valve, when open, allows fuel to flow from the couplings into the trim transfer pipes. The valve is opened mechanically by the control handle, which operates a rack-and-pinion mechanism. A visual indicator displays OPEN, SHUT and FAILED.

When the control handle is moved clockwise to the open position, the isolating valve head is moved against spring pressure by the rack-and-pinion mechanism. At the fully open position, the control handle operates a microswitch to initiate energization of a latchpin solenoid which locks the rack and holds the valve open. The visual indicator will display OPEN. Moving the control handle to the shut position opens the microswitch contacts to effect de-energization of the latchpin solenoid and shut the valve. The visual indicator will display SHUT. The latchpin solenoid can be de-energized, independently of control handle operation, by certain abnormal refuelling conditions; when this occurs, the latchpin is withdrawn and the valve closes under spring action, the control handle remains in the open position and the microswitch contacts remain closed, but the indicator displays FAILED. The FAILED display is therefore an indication of the loss of electrical power to the latchpin solenoid.

As the valve closes, any differential pressure across the valve head is balanced by means of bleed holes and the closing rate is regulated by a damper assembly to prevent excessive surge pressures. When the valve is shut, any fuel pressure caused by thermal expansion in the manifold is dissipated into the trim pipe via bleed holes and a spring-loaded ball valve in the rack assembly. Drain plugs are mounted at the base of the isolation valve housing to allow removal of water.

3. <u>Refuel Tank Inlet Valve</u> (Ref. Fig. 004)

Twelve of these electrically operated valves are fitted to control the refuelling of the individual tanks (tanks 1 to 10); tank 11 is refuelled via its left-hand trim valve (Ref. 28-23-00, Description and Operation). Five of the valves, fitted with 1 in dia. spherical plugs, are used to refuel tanks 2, 3, 5A, 7A, and 7; the remaining seven valves, fitted with 2 in dia. spherical plugs and non-return valves,



R - Refuel Tank Inlet Valve
Figure 004

R are used to refuel the forward tanks (tanks 1, 4, 5, 8, 9 and
R 10) and tank 6.

R Each valve comprises a motorized valve element mounted in a
R canister which allows the removal of the valve element without
R the necessity of defuelling the tank. The valve element houses
R a rotary, two-position, valve plug which is driven by an
R electric motor through a reduction gearbox. The motor has
R an electro-mechanical brake, torque-limiter clutch and overrun
R stops; cam-operated limit switches are fitted to control motor
R operation and to actuate remote indicators on the refuel
R control panel.

R A flange on the valve element has three cut-outs and three
R lugs. The cut-outs enable the valve to be located correctly
R in the canister during assembly, and the lugs act as stops to
R ensure correct final installation. A locating dowel on the
R valve ensures that the motor can be fitted in only one
position.

R The non-return valve, incorporated in the 2 in dia. valves,
R comprises a valve plate on a spring-loaded arm. The 2 in dia.
R valves are also fitted with a baulking pin on the periphery of
R the valve element body to ensure that the correct valve element
R is being fitted. If the pin fouls against an extension of the
R top flange in the canister support, an incorrect valve element
R is being used (e.g., a cross-feed valve, which is not fitted
R with a non-return valve).

R A captive drain-plug, screwed into the valve element flange,
R enables the canister to be drained during servicing operations;
R mechanically operated 'pop out' plungers provide a visual
R indication of valve position against OPEN and SHUT markings
R on the valve.

R The valves are controlled either manually by switches on the
R refuel control panel, or automatically by certain electrical
R control circuits. When the aircraft is in flight, certain
R refuel valves can be used for trim purposes; control in this
R case is by switches on the fuel management panel.

4. Refuel Protection Pressure Switch

R Before SB 28-035

R This is a diaphragm-type switch (Ref. 28-13-00, Description
R and Operation, Fig.004) which operates a microswitch
through a spring-loaded linkage in response to
pressure differences between the trim transfer pipe and
the tank. The microswitch operates to illuminate a
R caption, inscribed OVER PRESS, when the trim transfer pipe

pressure is between 59 and 64 psig (4.068 and 4.413 bar) above tank pressure, a condition which may occur in the event of failure of ground refuelling equipment. Two of these switches are fitted, one in the underwing fairing below tank 5 and the other in the underwing fairing below tank 8.

After SB 28-035 For A/C 001-005,

This is a diaphragm-type switch (Ref. 28-13-00, Description and Operation, Fig.004) which operates a microswitch through a spring-loaded linkage in response to pressure differences between the trim transfer pipe and the tank. The microswitch operates to illuminate a caption, inscribed OVER PRESS, when the trim transfer pipe pressure is between 70 and 76 psig (4.830 and 5.244 bar) above tank pressure, a condition which may occur in the event of failure of ground refuelling equipment. Two of these switches are fitted, one in the underwing fairing below tank 5 and the other in the underwing fairing below tank 8.

5. Load Limit Control Selectors (Ref. Fig. 005)

Four load limit control selectors on the refuel control panel are provided for tank 5 or 6, tank 7 or 8, tank 9 or 10 and tank 11. Each selector has a setting knob which may be used to pre-set a partial fuel loading on a digital indicator. These selectors enable any desired fuel loading to be achieved automatically. The normal loading requirement is such that not more than four tanks are partially filled; the other tanks are either completely filled or left empty. Next to each selector is a three-position tank selector switch, except for tank 11 which has a two-position switch. With a tank selector switch at OFF, its load limit control selector is isolated and the tanks are refuelled under the control of their refuel inlet valve switches and the high level switching channels.

6. Refuel Panel Door Microswitch (Ref. Fig. 006)

The action of opening and closing the refuel control panel access door 194 JB operates a microswitch via an adjustable actuating lever. The microswitch is fitted near the refuel control panel.

When the refuel panel door is opened, the microswitch -

(1) de-energizes the refuel magnetic indicator at the top

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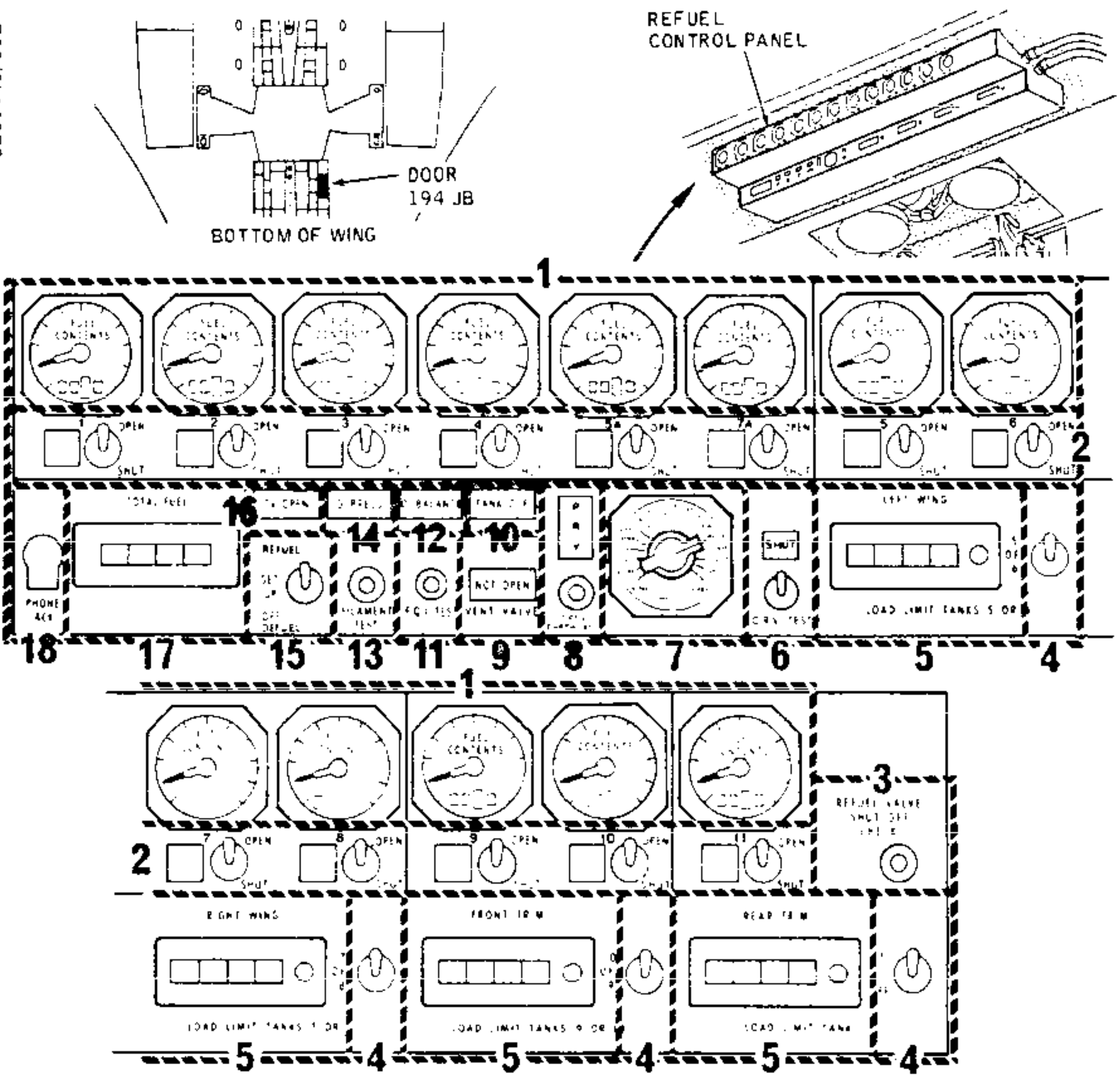

1 FUEL QUANTITY INDICATOR
2 REFUEL VALVE SWITCH AND INDICATOR
3 REFUEL VALVE SHUT-OFF CHECK SWITCH
4 TANK SELECTOR SWITCH
5 LOAD LIMIT CONTROL SELECTOR
6 ORV TEST SWITCH AND INDICATOR
7 TPRV SELECTOR SWITCH
8 TPRV EARTH TEST SWITCH
9 VENT VALVE NOT OPEN WARNING CAPTION
10 TANK OVERFULL WARNING CAPTION
11 FUEL QUANTITY INDICATOR TEST SWITCH
12 AIRCRAFT OVERBALANCE WARNING CAPTION
13 FILAMENT TEST SWITCH
14 REFUELLING OVERPRESSURE WARNING CAPTION
15 REFUEL MASTER SWITCH
16 TRIM VALVE OPEN WARNING CAPTION
17 TOTAL FUEL QUANTITY INDICATOR
18 PHONE JACK

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R - Refuel System - Controls and Indicators
Figure 005

R of the fuel management panel, to change its display from FLT to GRD,

R NOTE: This occurs only if the refuel master switch is at OFF-DEFUEL. If the switch is not at OFF-DEFUEL then the magnetic indicator will already display GRD, even with the refuel panel door shut.

R (2) provides a ground power supply to energize the refuel panel lighting control relay, on panel 10-123 in the forward underfloor racking (this relay provides instrument and service lighting for the refuelling operation),

R (3) provides a ground power supply to the load limit control circuits, the totalizer and the level switching packs, and

R (4) provides a ground power supply to energize the ground/flight control relay on panel 18-123 in the RH fuel relay box in the forward underfloor racking (this relay arms certain refuel circuits).

7. Operation

A. Control and Indication (Ref. Fig. 005)

R The refuelling controls and indicators are on the refuel control panel, located behind an access door in the right-hand underwing fairing. The various control circuits are armed by a microswitch fitted near the control panel and actuated by opening the access door.

R The refuel tank inlet valves for all tanks are controlled by separate switches with adjacent valve position indicators and by the high level switching channel for the appropriate tank. The valves for tanks 5, 6, 7, 8, 9, 10 and 11 are also controlled by load limit control selectors on the refuel control panel. When the refuel control panel is electrically isolated, the valves for tanks 1, 2, 3, 4, 5, 6, 7, 8 and 10 are also controlled by STANDBY INLET VALVE switches on the fuel management panel.

R The load limit control selectors and their adjacent tank selector switches are used when partial fuel loading is required. The appropriate tank and its loading is selected by means of the switch and setting knob, and then the refuel inlet valve for the selected tank shuts automatically when the pre-set load limit is reached. The tank not selected may still be refuelled to high level in the normal manner.

Fuel quantity indicators are provided for each tank, each indicator having a dial and a digital presentation. The total fuel quantity is indicated on a digital indicator.

A refuel master switch with three positions, OFF-DEFUEL, SET-UP and REFUEL, arms the various control, test and warning circuits. When set to OFF-DEFUEL (flight position) and the refuel control panel access door is closed, the control panel is electrically isolated.

B. Functional Description (Ref. Fig. 006, 007 and 009)

With electrical power connected and the aircraft prepared for refuelling (Ref. 12-11-28), the action of opening the refuel control panel access door operates the refuel door microswitch (Ref. para.6.), which energizes the ground/flight control relay.

When the ground/flight control relay is energized, its contacts effect the following changes:-

(1) The control of tanks 1, 2, 3, 4, 5, 6, 7, 8 and 10 refuel inlet valves is transferred from their STANDBY INLET VALVE switches on the fuel management panel to their individual switches on the refuel control panel.

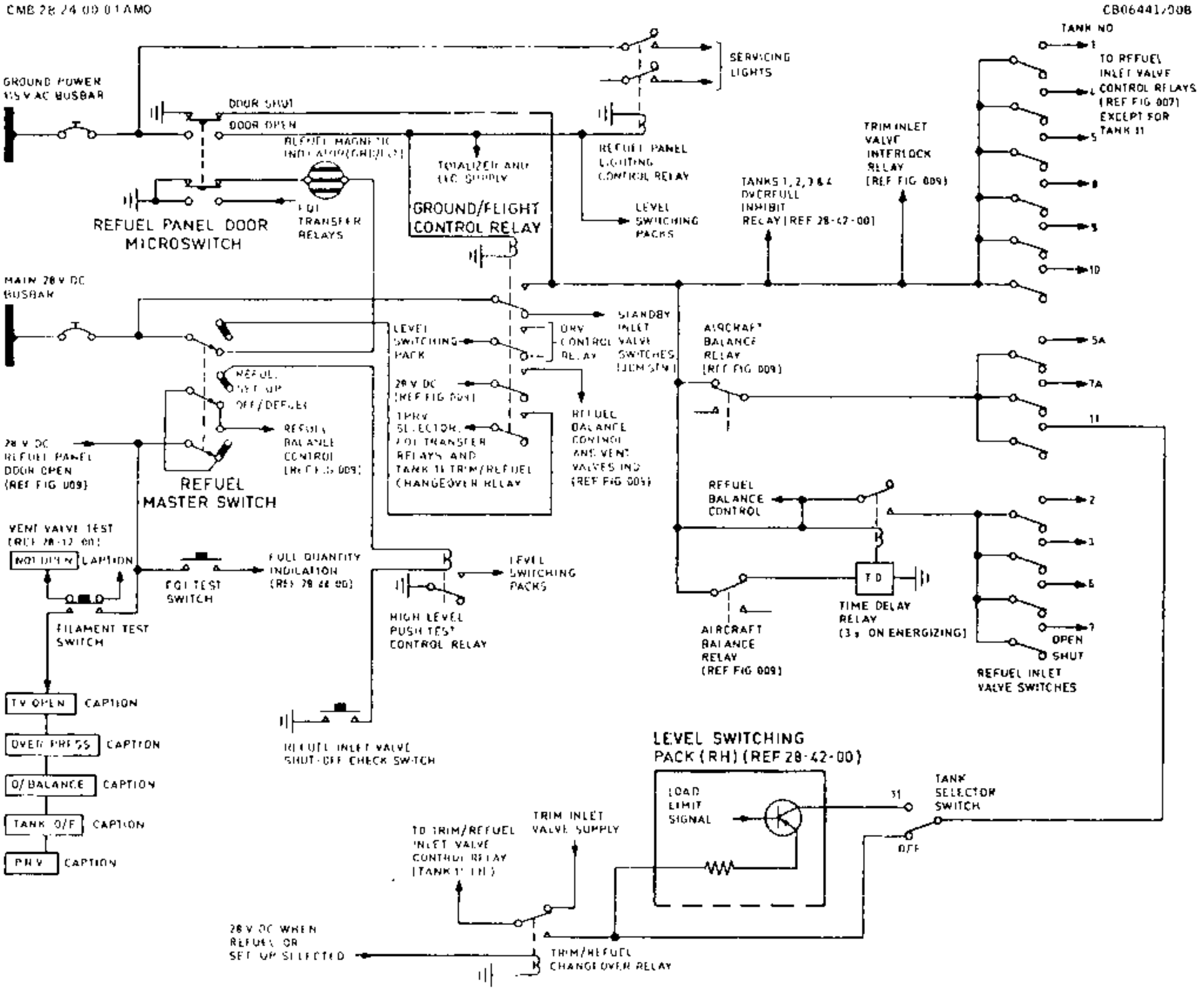
(2) A supply is provided to tanks 9, 5A and 7A refuel inlet valve switches on the refuel control panel.

<u>NOTE</u>: Inlet valves for tanks 9, 5A and 7A are not controlled from the fuel management panel.

Tank 11 LH trim/refuel inlet valve remains under the control of the trim transfer system MAIN and O/RIDE switches on the fuel management panel until the refuel master switch is set to SET-UP or REFUEL.

(3) A circuit is completed from the overflow relief valve (ORV) sensors in the scavenge tank, via a level switching pack, to the coil of the ORV control relay. This circuit also arms the ORV TEST switch (Ref. 28-12-00).

(4) A supply is provided to the refuel balance control circuit (Ref. Fig. 009) and, provided that the aircraft balance is normal, this supply is continued to two terminals of the refuel master switch.



R

Refuel Control Circuit
Figure 006

EFFECTIVITY: ALL

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(5) A supply is provided to the vent valves indication circuit (Ref. 28-12-00).

(6) A supply is also provided (when the refuel master switch is set to SET-UP or REFUEL) to the tank pressure relief valve (TPRV) selector, the fuel quantity indicator (FQI) transfer relays and tank 11 trim/refuel change-over relay (Ref. Fig. 006).

With the refuel master switch at OFF-DEFUEL, the aircraft balance normal and the refuel door open, the following circuits are armed:-

(1) The aircraft 'overbalance' warning caption circuit, primarly controlled by the nose-leg weight micro-switches.

(2) The overfull inhibit relay circuit for tanks 1, 2, 3 and 4, to prevent an overfull signal from these tanks when their refuel inlet valves are shut.

(3) The 'trim valve open' warning caption circuit, via the trim inlet valve interlock relay.

(4) The 'tank overfull' warning caption circuit via the level switching pack.

(5) The 'filament test' facility.

(6) The circuits of the refuel control unit (RCU) micro-switches, via the time delay relays and overpressure control relays.

<u>NOTE</u>: The refuelling 'overpressure' warning caption circuit is armed as far as either the LH or the RH overpressure control relay (Ref. Fig. 009).

(7) The 'FQI test' facility.

When the refuel master switch is moved to SET-UP, those conditions that prevailed at OFF-DEFUEL are maintained, with the following exceptions and additions:-

(1) The refuelling 'overpressure' warning caption circuit is disarmed.

(2) The refuel inlet valve shut-off check switch circuit is armed via the coil of the high level push test control relay.

(3) The trim/refuel change-over relay is energized,

which transfers control of tank 11 LH trim/refuel inlet valve control relay from the switch on the fuel management panel to the switch on the refuel control panel.

(4) The fuel quantity indication is transferred from the fuel management panel to the refuel control panel via the FQI transfer relays.

NOTE: The FQIs for tanks 9, 10 and 11 on the fuel management panel will continue to operate but all digital indication and the dial indication for other tanks will be electrically isolated.

(5) The tank pressure relief valve (TPRV) selector switch and earth test switch circuits are armed.

When the refuel master switch is moved to REFUEL, those conditions that prevailed at SET-UP are maintained, except as follows:-

(1) The refuel inlet valve shut-off check switch circuit is disarmed.

(2) The refuelling 'overpressure' warning caption circuit is re-armed.

Two nose-leg weight microswitches provide aircraft overbalance protection; these switches are adjusted to operate simultaneously when the nose landing gear shock-absorber extension is between 22.82 and 24.20 in (580 and 615 mm) (Ref. 28-00-00, Servicing, Fig.304). The switches are interconnected to two aircraft balance relays and an aircraft balance indication relay (Ref. Fig. 009).

If an overbalance condition occurs and the tank 11 LH trim/refuel inlet valve is shut, i.e., the tank 11 LH trim/refuel inlet valve position relay is energized, the nose-leg weight microswitches operate and the coil of their associated aircraft balance relay is energized, causing the refuel inlet valves of tanks 5A and 7A to shut immediately (1 to 2 s) and the refuel inlet valves of tanks 2, 3, 6 and 7 to shut after a 3 s delay. This delay is to prevent excessive pressure surges in the aircraft piping. However, the 28 V d.c. supply is maintained to the coil of the aircraft balance indication relay via the tank 11 LH trim/refuel inlet valve position relay; the same supply is also maintained to the LH and RH refuel shut-off time delay relays via the refuel master

switch. Therefore, in these conditions, the O/BALANCE warning caption will not be illuminated.

When the aircraft balance returns to normal, the aircraft balance relays are de-energized and the normal power supplies are restored to re-open the refuel inlet valves which have shut.

If an over-balance condition occurs and the tank 11 LH trim/refuel inlet valve is open, the tank 11 LH trim/refuel inlet valve position relay is de-energized and therefore the 28 V d.c. supplies to the aircraft balance indication relay and the refuel shut-off time delay relays will be interrupted as long as the tank 11 valve remains open. However, in these conditions, tanks 5A, 7A, and 11 valves are shut immediately (1 to 2 s) with a momentary illumination of the O/BALANCE warning caption, until the tank 11 valve position relay is energized; tanks 2, 3, 6 and 7 valves will shut after a 3 s delay.

If tank 11 valve does not shut, i.e., the tank 11 valve position relay remains de-energized, the O/BALANCE caption will remain illuminated and, after a delay of 5 s from the break in supplies, the energized refuel shut-off time delay relays will de-energize and cause the refuel control unit (RCU) solenoids to de-energize and shut down both RCUs to the FAILED condition.

If one of the nose-leg weight microswitches fails to operate, similar shut-down of both RCUs will occur as the aircraft balance indication relay is de-energized and the 28 V d.c. supplies to the refuel shut-off time delay relays are interrupted.

A controlled avalanche diode is fitted across the time delay circuit of the refuel shut-off time delay relays to prevent spurious RCU shut-downs.

Magnetic indicators, next to each refuel inlet valve switch on the refuel control panel, display yellow when the valve is open and black when the valve is shut; these indicators are energized in the 'valve shut' position only (Ref. Fig. 007); however, further indication of the position of these same valves (for tanks 1, 2, 3, 4 and 10 only) may be obtained from the STANDBY INLET VALVES magnetic indicators on the fuel management panel (3CM station). These indicators are energized in both 'valve open' and 'valve shut' positions, displaying OPEN and SHUT, and diagonal stripes when the valve is in transit. The tank 11 magnetic indicator is operated by a position

relay (Ref. Fig.008 and 009). The position relay also forms part of the overbalance protection circuit (Ref. Fig. 009).

During a normal refuelling operation, the refuel inlet valves for each tank shut automatically as a result of a signal from the high level sensors or load limit controllers via the level switching packs and valve control relays. Each refuel inlet valve may also be shut manually by means of its associated OPEN - SHUT switch. An overfull circuit (Ref. 28-42-00) for each tank is inhibited when the associated refuel inlet valve is shut, but if any valve remains open or partially open when it has been automatically or manually selected shut, the overfull circuit is not inhibited.

If the tank then overfills, an overfull signal from the tank probe to the associated level switching pack will cause immediate illumination of a single TANK O/F warning caption on the refuel control panel (Ref. Fig. 009). The same signal causes interruption of the power supplies to the refuel shut-off time delay relays, and the relays are immediately de-energized, which removes the power supplies to the refuel control unit (RCU) solenoids and both RCUs shut down to the FAILED condition.

If either of the refuel protection pressure switches (Ref. Fig. 009) senses an overpressure condition, the control supply to the associated refuel shut-off time delay relay is interrupted and, if the overpressure condition exists for 5 s, the time delay relay is de-energized to -

(1) energize the overpressure control relay, via contacts of the pressure switch and time delay relay and

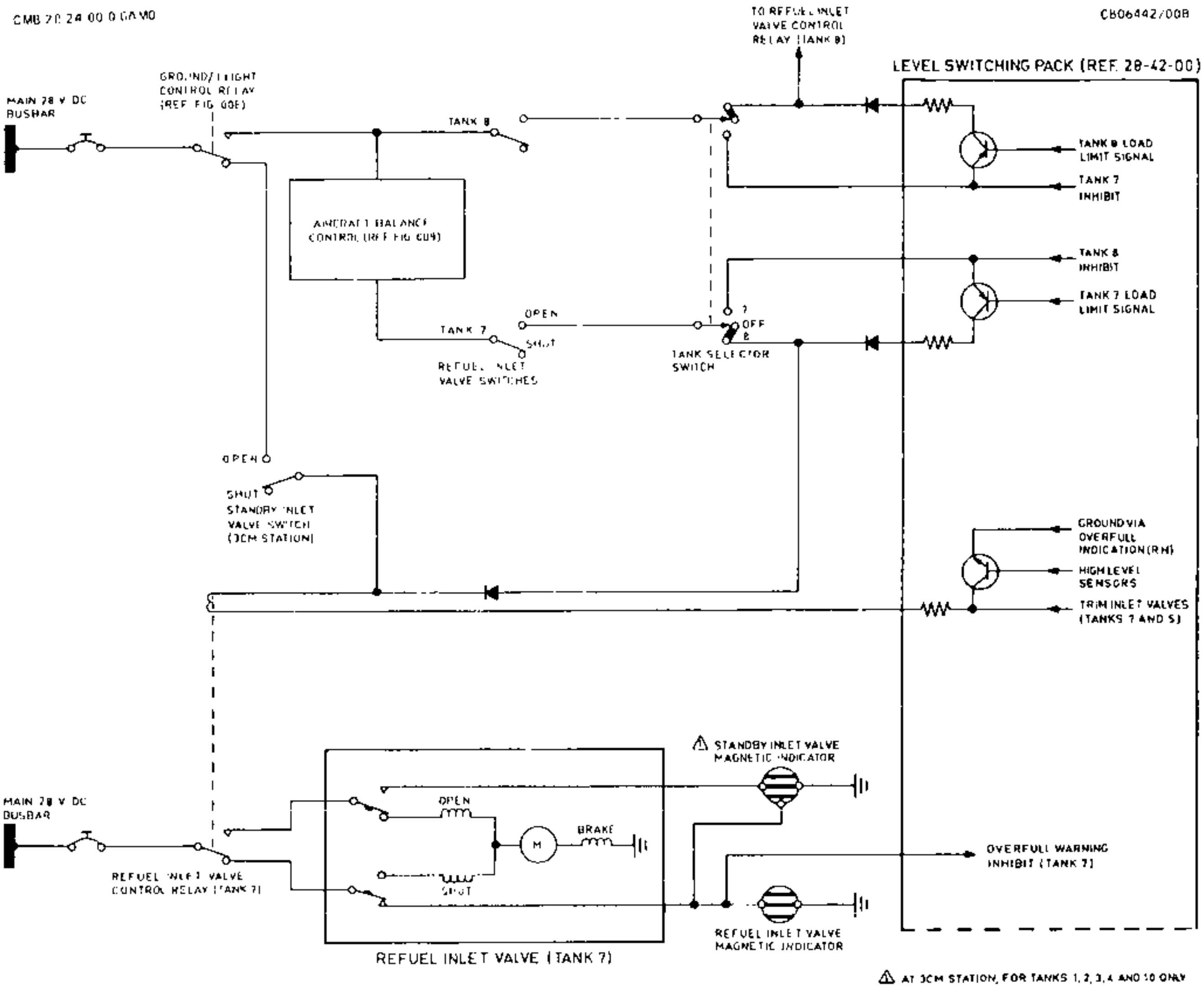
(2) interrupt the power supply to the associated RCU solenoid, thus shutting down the RCU to the FAILED condition.

Contacts of the energized overpressure control relay -

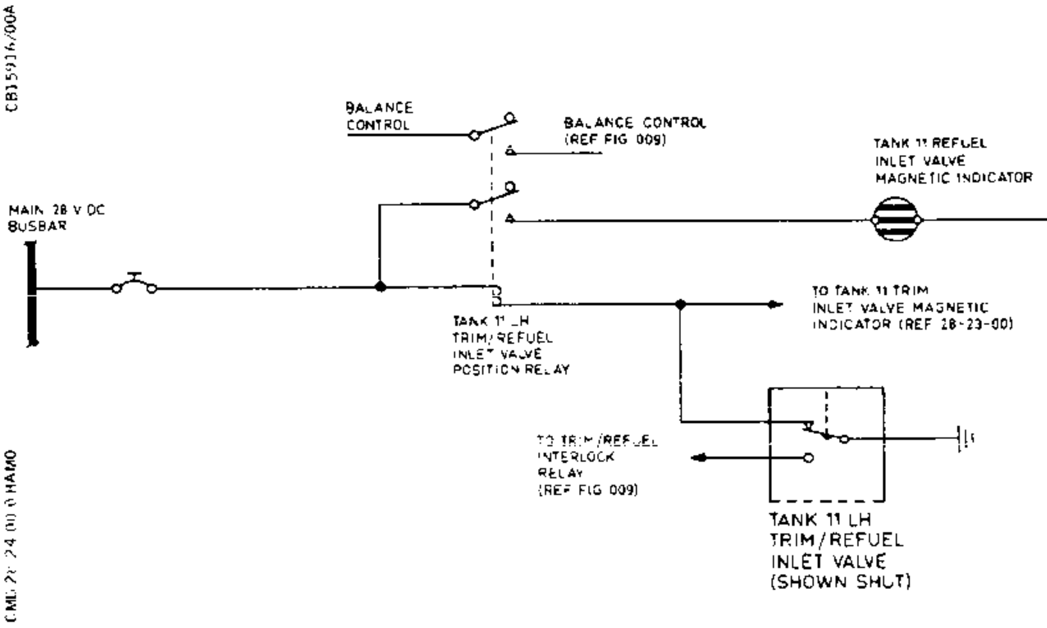
(1) effect illumination of the OVER PRESS warning caption and

(2) complete an electrical hold-on circuit for the over-pressure control relay, via the closed RCU microswitch contacts.

Thus, when the overpressure condition is subsequently



R - Refuel Tank Inlet Valve Control Circuit - Typical
Figure 007



-Tank 11 LH Refuel Tank Inlet Valve Indication Circuit
Figure 008

rectified, the caption remains illuminated until the RCU handle is moved manually to the closed position to open the microswitch contacts and break the hold-on circuit. Refuelling of tanks supplied by the other RCU is continued normally.

The trim inlet valves (Ref. 28-23-00) must remain shut during the refuelling operation. In this state, the trim inlet valve interlock relay (Ref. Fig. 009) is de-energized and its contacts connect a 28 V d.c. power supply to the refuel shut-off time delay relays via the level switching pack, the closed contacts of the refuel control unit microswitches and the de-energized over-pressure control relays. The trim inlet valves 'open' contacts for tanks 11 RH, 7, 5, 9 LH and 9 RH are connected directly to the coil of the trim inlet valve interlock relay. Tank 11 LH trim/refuel inlet valve 'open' contact is connected to the trim inlet valve interlock relay via a trim/refuel interlock relay which is energized during refuelling provided that the tank 11 LH trim inlet valve override switch, on the fuel management panel, is set to OFF (the normal ground setting).

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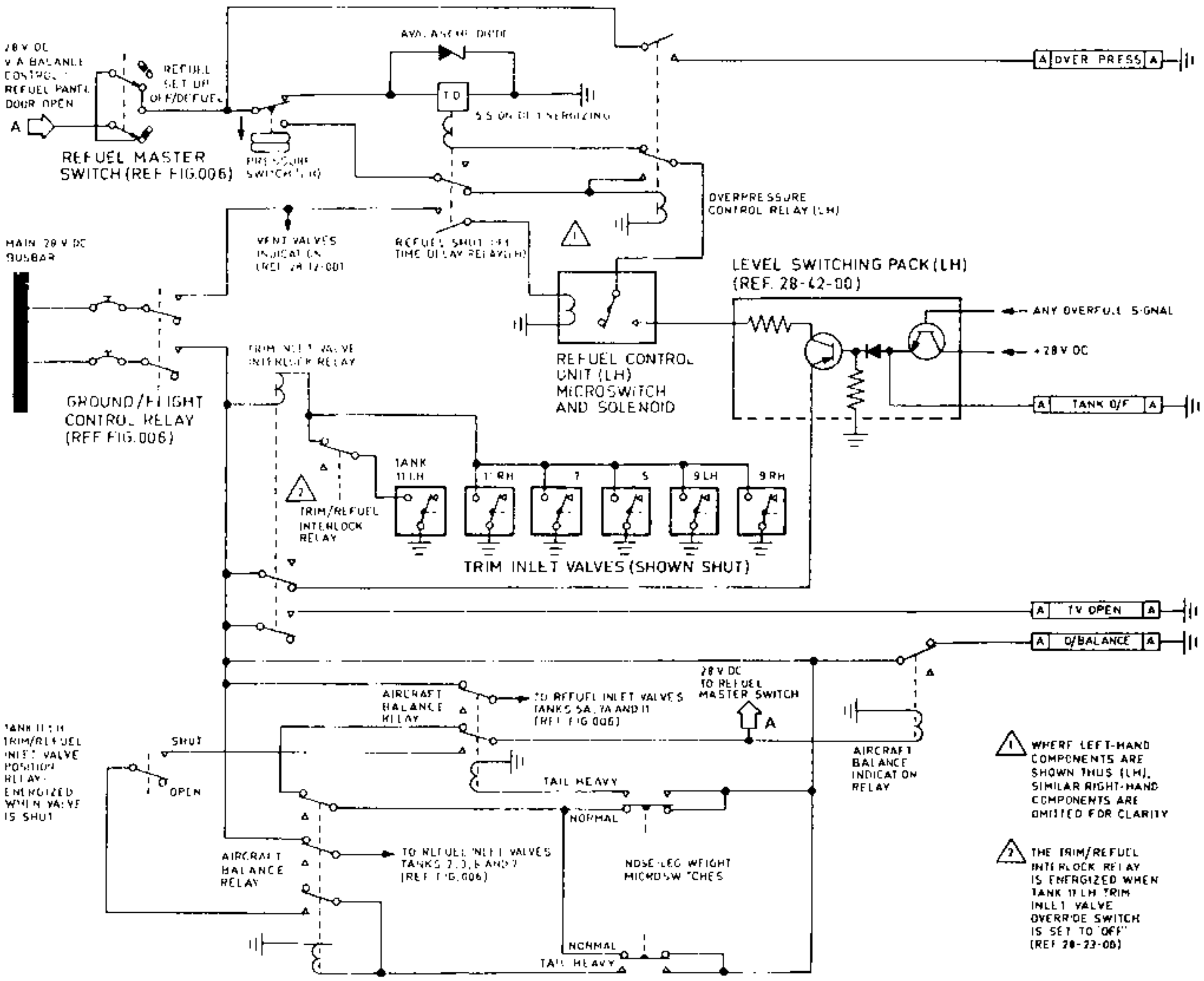

R Refuel Shut-off Circuits
Figure 009

R Therefore, when tank 11 LH trim/refuel inlet valve is opened during refuelling it will not complete the circuit from the coil of the trim inlet valve interlock relay. However, if any other trim inlet valve is not shut, its contacts will complete a circuit to energize the trim valve interlock relay, which then provides a supply to illuminate a single TV OPEN warning caption on the refuel control panel. At the same time, the trim inlet valve interlock relay interrupts the 28 V d.c. power supply to the refuel shut-off time delay relays (via the level switching pack, the RCUs and the overpressure control relays) causing the RCU solenoids to de-energize immediately and both RCUs to shut down to the FAILED condition.

R The refuel inlet valve switches for all tanks except tank 11 are set to OPEN to provide power supplies to the refuel inlet valve control relays (via tank selector switches for tanks with load limit control facility). Tank 11 refuel inlet valve switch provides a power supply to its trim/refuel inlet valve control relay via the tank selector switch and a trim/refuel change-over relay (Ref. Fig. 006) which controls the dual function of the trim/refuel inlet valve. When the refuel master switch is at SET-UP or REFUEL, the trim/refuel change-over relay is energized and the valve is controlled from its switch on the refuel control panel, but electrical power for the change-over contacts of the valve control relay is provided via the OFF contacts of its associated trim inlet valve override switch (Ref. 28-23-00).

R When the FILAMENT TEST switch on the refuel control panel is pressed, a supply is provided to illuminate the TV OPEN, OVER PRESS, TANK O/F and PRV warning captions for test purposes (Ref. Fig. 006). Pressing the switch also interrupts a supply in the vent valve test circuit (Ref. 28-12-00) to illuminate the vent valves NOT OPEN warning caption.

R When the fuel quantity indicator (FQI) test switch on the refuel control panel is pressed, a supply is provided to the fuel quantity indication circuit (Ref. 28-44-00) and the FQIs display a specified increase (Ref. Adjustment/ Test) for test purposes.

R A phone jack on the refuel control panel remains operable in any refuelling condition when the ground/flight control relay is energized.

R 8. Electrical Power Supplies

Electrical power supplies for equipment in the refuel

system are detailed in Table 1.

	SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
R R	Ground power refuel control and indication	Ground power 115 V a.c.	25-216
R	Refuel control and fail indication	'A' main 28 V d.c.	15-215
R R	Refuel shut-off and vent valves indication	'A' main 28 V d.c.	15-215
R R	Tank 11 LH inlet valve main supply	'A' main 28 V d.c.	15-215
R R	Tank 11 LH inlet valve override supply	'B' essential 28 V d.c.	3-213
R R	Refuel inlet valve supplies:		
	Tank 10	'A' main 28 V d.c.	15-215
	Tank 7	'A' main 28 V d.c.	15-215
	Tank 5	'A' main 28 V d.c.	15-215
	Tank 8	'A' main 28 V d.c.	15-215
	Tank 6	'A' main 28 V d.c.	15-215
	Tank 4	'A' main 28 V d.c.	15-215
	Tank 1	'A' main 28 V d.c.	15-215
	Tank 9	'B' main 28 V d.c.	15-216
	Tank 3	'B' main 28 V d.c.	15-216
	Tank 2	'B' main 28 V d.c.	15-216
	Tank 7A	'B' main 28 V d.c.	15-216
	Tank 5A	'B' main 28 V d.c.	15-216

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL

Electrical Power Supplies
Table 1

REFUEL - TROUBLE SHOOTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4., 5., 6. and 7.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

The basic principle of the procedures is that tests which can be effected by manual switching are carried out first, followed by tests that require the use of equipment.

The procedures are grouped, for convenience of application, under the following headings. The items covered are listed under each heading, in the order in which they are dealt with.

Refuel Switching (Ref. para.3.)

Fuel management panel ground/flight indicator.

Power supplies to refuel panel.

Refuel panel captions.

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Refuel control unit (RCU) power failure.

Fuel quantity indication (FQI) power supplies.

Refuel valve operation.

Trim valve opening and RCU shut-off.

Load Limit Control (Ref. para.4.)

Power supplies to, and operation of, the associated refuel valves via their load limit controllers.

Overbalance Protection (Ref. para.5.)

Nose landing gear weight operated micro-switches - check for dormant faults.

Overpressure Protection (Ref. para.6.)

Pressure switches and RCU shut-off - operating pressures.

Tank Refuelling Rate, Including High Level Shut-off and Overfull Shut-off (Ref. para.7.)

Refuelling of individual tanks, high level shut-off and overfull indication with RCU shut off.

Where circuits for refuel valves are similar and incorporate identical components, e.g., Control Switches, Control Relays and Valves, all references to the associated components listed in Table 101 are given as follows:-

Renew Refuel Valve (55), (56), (57), (62) or (63).

The following is the basic sequence of testing tank associated components: tank 9, 10, 1, 4, 5, 8, 6, 7, 2, 3, 5A, 7A and 11.

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Multimeter	-
Nose jack (Ref. 7-11-00)	-

DESCRIPTION	PART NO.
Safety stay (Ref. 7-11-00)	
Nose jacking pad	D925370000
Refuel pressure test rig	-
Refuelling facility	-

B. Prepare

(1) Ensure that circuit breakers (Ref. Table 101) are set.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(4) Ensure, by reference to the aircraft attitude
R indicator (Ref. 12-11-10, Refuelling - Associated
R Operations) that the bubble is within the nominal
R ground attitude envelope.

(5) Ensure that the initial fuel state in the tanks is as follows:- 50 % in each of tanks 9, 10, 1, 4, 5 and 8, and not more that 10 % in each of tanks 6, 7, 2, 3, 5A, 7A and 11. If necessary, refuel (Ref.12-11-28), transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing).

(6) Display warning placards at the fuel management panel (3CM station) and refuel control panel to indicate that work is being carried out on the fuel system.

(7) Except for the use of electrical ground power, the tests in paragraphs 3. and 4. do not require any ground equipment.

(8) For the requirements of paragraph 5., ensure that -

(a) the nose shock absorber strut is correctly charged (Ref. 32-21-24, Servicing),

(b) the weight on the nose wheel is not less than 4,000 kg, i.e., dimension 'D' is not greater than 19.5 in (495 mm) (Ref. Weight and Balance Manual, 1-80-00, Aircraft Balance During Ground Operations),

(c) the aircraft is clear of personnel, and

(d) the nose jack is attached to frame 28 jacking point with a safety stay at frame 72 (Ref. 7-11-00).

(9) For the requirements of paragraph 6., connect the fuel pressure test rig to the LH refuel control unit.

(10) For the requirements of paragraph 7., connect a refuelling facility to each refuel control unit (Ref. 12-11-28).

R
R
R
R
R
R
R

NOTE: For this test the aircraft should preferably be fully equipped, so that the zero fuel c.g., and hence the fuel loaded c.g., can be accurately determined (Ref. 12-00-10, Aircraft Ground Stability), otherwise tanks 2, 3, 6 and 7 must be defuelled before tank 11 is filled.

3. Trouble Shooting - Refuel Switching

```
A.*****************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At lower electrical services panel     *
  *(6-214), press LIGHTS CTR switch to     *
  *"TEST".  Check that RE-FUEL indicator,  *
  *on panel 2-214 is illuminated.  IF -    *
  *****************************************
               |    |
               |    |       -----------------------------------
               OK   NOT OK------|Renew filament(s) (Ref. 33-14-00).|
               |                -----------------------------------
               |
B.*****************************************
  *With the refuel panel door shut, check  *
  *that RE-FUEL indicator displays FLT.    *
  *IF -                                    *
  *****************************************
               |    |
               |    |       -----------------------------------
               |    |      |RE-FUEL indicator displays GRD      |
               OK   NOT OK------|when panel door is shut and master|
               |           |switch is at OFF = DEFUEL =        |
               |           |Chart 101.                         |
               |            -----------------------------------
               |
C.*****************************************
  *Open refuel panel 1-194 access door.    *
  *Check that RE-FUEL indicator displays   *
  *GRD.  IF -                              *
  *****************************************
               |    |
               |    |       -----------------------------------
               |    |      |RE-FUEL indicator displays FLT      |
               OK   NOT OK------|when panel door is open -         |
               |           |Chart 102.                         |
               |            -----------------------------------
               |
D.*****************************************
  *Set master switch to "SET UP", and close*
  *refuel panel access door. Check that    *
  *RE-FUEL indicator displays GRD. IF -    *
  *****************************************
               |    |
```

```
                |     |
                |     |          ------------------------------------
               OK    NOT OK------|Renew Refuel Master Switch (21).  |
                |                ------------------------------------
                |
                |
E.*****************************************
  *Open refuel panel access door and reset *
  *master switch to "OFF - DEFUEL". Check  *
  *that FQI gauges are integrally          *
  *illuminated, and failure warning flag in*
  *TOTAL CONTENTS indicator is             *
  *withdrawn.  IF -                        *
  *****************************************
                |     |
                |     |          ------------------------------------
                |     |         |1. All FQI gauges are not illumi-  |
               OK    NOT OK------|   nated - refer to 33-32-00,      |
                |               |   Trouble Shooting.               |
                |               |2. TOTAL CONTENTS indicator        |
                |               |   failure flag does not withdraw  |
                |               |   - refer to 28-44-00, Trouble    |
                |               |   Shooting.                       |
                |               |3. FQI gauges are not illuminated  |
                |               |   and TOTAL CONTENTS indicator    |
                |               |   failure flag is displayed       |
                |               |   when refuel panel door is open  |
                |               |   - Chart 103.                    |
                |                ------------------------------------
                |
F.*****************************************
  *Check that TV OPEN, O/PRESS, O/BALANCE, *
  *TANK O/F and NOT OPEN captions are not  *
  *illuminated.  IF -                      *
  *****************************************
                |     |
                |     |          ------------------------------------
                |     |         |1. O/BALANCE caption is illumi-    |
               OK    NOT OK------|   nated - operate FILAMENT TEST   |
                |               |   switch and check that other     |
                |               |   captions are illuminated. If    |
                |               |   captions are not illuminated -  |
                |               |   Chart 104.                      |
                |               |   If captions are illuminated -   |
                |               |   check associated wiring for     |
                |               |   continuity and renew Balance    |
                |               |   Indication Relay (53).          |
```

2. TV OPEN caption is illuminated before FILAMENT TEST switch is operated - Chart 105.
3. O/PRESS caption is illuminated before FILAMENT TEST switch is operated - Chart 106.
4. TANK O/F caption is illuminated before FILAMENT TEST switch is operated - refer to 28-42-00, Trouble Shooting.
5. NOT OPEN caption is illuminated before FILAMENT TEST switch is operated - refer to 28-12-00, Trouble Shooting.

G. Press and release the FILAMENT TEST switch. Check that TV OPEN, O/PRESS, O/BALANCE, TANK O/F, NOT OPEN and PRV captions are illuminated and then extinguished. IF -

OK

NOT OK:

1. If NOT OPEN caption is not illuminated - renew filaments. If fault not cleared - refer to 28-12-00, Trouble Shooting.
2. If any single caption, other than NOT OPEN, is not illuminated - renew associated filaments.
3. Refuel panel captions are not illuminated when FILAMENT TEST switch operated - Chart 107.
4. All captions become and remain illuminated - renew Test Switch (27).

H. Set LH and RH RCUs (Refuel Control Units) to open. Check that RCU indicators display OPEN. IF -

```
                |     |
                |     |         ----------------------------------
                |     |        |1. Both RCU indicators display    |
               OK   NOT OK-----|   FAILED when master switch at   |
                |              |   OFF DEFUEL - Chart 108.        |
                |              |2. LH or RH RCU indicator displays|
                |              |   FAILED when master switch at   |
                |              |   OFF DEFUEL - Chart 109.        |
                |               ----------------------------------
                |
I.*****************************************
  *At fuel management panel, note the     *
  *quantities displayed by the FQIs. Set  *
  *the refuel master switch to "SET UP".  *
  *Check that:-                           *
  *PRV caption is illuminated; FQI failure *
  *flags are withdrawn and FQI readings    *
  *agree with fuel management panel FQIs; *
  *and, after a 5 s time delay, both RCU  *
  *indicators display FAILED.  IF -       *
  *****************************************
                |     |
                |     |         ----------------------------------
                |     |        |1. PRV caption is not illuminated |
               OK   NOT OK-----|   and FQI failure flags are not  |
                |              |   withdrawn when master switch   |
                |              |   at SET UP - Chart 110.         |
                |              |2. PRV caption is not illuminated |
                |              |   when master switch at SET UP - |
                |              |   refer to 28-12-00, Trouble     |
                |              |   Shooting.                      |
                |              |3. All FQI failure flags are not  |
                |              |   withdrawn when master switch   |
                |              |   at SET UP - check associated   |
                |              |   wiring for continuity and renew|
                |              |   Refuel Door Operated           |
                |              |   Microswitch (20).              |
                |              |4. Tank 9, and/or 10, and/or 11   |
                |              |   FQI failure flags are not      |
                |              |   withdrawn - trouble shoot main |
                |              |   CG Pack (23) (Ref. 28-44-00,   |
                |              |   Trouble Shooting).             |
                |              |5. Tank 1, and/or 2, and/or 5,    |
                |              |   and/or 5A, and/or 6 FQI        |
                |              |   failure flags are not withdrawn|
                |              |   - trouble shoot Quantity Pack B|
                |              |   (25) (Ref. 28-44-00, Trouble   |
                |              |   Shooting).                     |
```

6. Tank 3, and/or 4, and/or 7, and/or 7A, and/or 8 FQI failure flags are not withdrawn - trouble shoot Quantity Pack A (24) (Ref. 28-44-00, Trouble Shooting).
7. If any single FQI fails to agree with its associated fuel management panel FQI - renew the indicator (Ref. 28-44-83, Removal/Installation).
8. If both RCUs remain at open - renew Refuel Master Switch (21).
9. If time delay is not with 5 to 6 s - renew Time Delay Relay (127) or (128).
10. Any single RCU indicator does not display FAILED when master switch set to SET UP - Chart 111.

J. Reset both RCUs to "SHUT".

K. Operate the FQI TEST switch. Check that tanks 1, 2, 3, 4, 5A and 7A indicators show an increase of approx. 200 kg, tanks 5, 6, 7, 8, 9, and 10 indicators show an increase of approx. 500 kg, tank 11 indicator shows an increase of approx. 3,000 kg and TOTAL CONTENTS indicator shows an increase of approx. 7,200 kg. IF -

NOTE: For an empty tank these values could be 30 per cent higher.

OK NOT OK

NOT OK:

1. Tanks 3, 4, 7, 7A and 8 indicators do not show increase; tanks 9 and 10 show only 250 kg increase and tank 11 starts to increase and then reverts to original reading - check associated wiring for continuity and renew Test Switch (26).
2. Tanks, 1, 2, 5, 5A and 6 indicators do not show increase; tanks 9 and 10 show only 250 kg increase and tank 11 starts to increase and then reverts to original reading - check associated wiring for continuity and renew Test Switch (26)
3. Any single indicator fails to show the required increase - refer to 28-44-00, Trouble Shooting.

OK:

L. Set all 13 refuel valve switches to "OPEN". Check that -

(a) associated valve position indicator display changes from black to yellow,

(b) standby inlet valve position indicators display (panel 2-214) for tanks 10, 1, 4, 2 and 3 changes from SHUT to diagonal stripes and then to OPEN,

(c) tank 11 LH trim inlet valve position indicator display (panel 5-214) changes from bar-across-line to diagonal stripes and then to bar-in-line,

<u>NOTE</u>: If tank 11 LH trim valve position indication faulty, refer to 28-23-00, Trouble Shooting.

(d) the OPEN 'pop-out' visual indicator on the valve is extended and

```
*NOTE:  Tank 11 LH trim/refuel valve does*
*       not have a 'pop-out' type indi-  *
*       cator. Its mechanical indicator  *
*       must be at OPEN.                 *
*(e) the valve is fully open within 2 s  *
*    of switch operation.  IF -          *
******************************************
           |    |
           |    |          ----------------------------------
           |    |         |1.  Tanks, 5A, 7A and 11 refuel   |
          OK   NOT OK-----|    valves do not open and O/     |
           |              |    BALANCE caption is not illumi-|
           |              |    nated - check associated      |
           |              |    wiring for continuity and     |
           |              |    renew Balance Relay (48).     |
           |              |2.  Tanks 6, 7, 2 and 3 refuel    |
           |              |    valves do not open and O/     |
           |              |    BALANCE caption is not        |
           |              |    illuminated - Chart 112.      |
           |              |3.  All 13 refuel valves do not   |
           |              |    open - renew Shut-off Control |
           |              |    Relay (32).  If fault not     |
           |              |    cleared - renew Refuel Valve  |
           |              |    Shut-off Check Test Switch    |
           |              |    (31).                         |
           |              |4.  Tank 1, 4, 2, 3, 5A or 7A     |
           |              |    refuel valve does not open -  |
           |              |    Chart 113.                    |
           |              |5.  Tank 9, 10, 5, 8, 6 or 7      |
           |              |    refuel valve does not open -  |
           |              |    Chart 114.                    |
           |              |6.  Tank 11 trim/refuel valve does|
           |              |    not open - Chart 115.         |
           |              |7.  Tank 10, 1, 4, 2 or 3 standby |
           |              |    inlet valve indicator does not|
           |              |    display OPEN, when associated |
           |              |    valve is open - Chart 116.    |
           |              |8.  Tank 10, 1, 4, 2 or 3 refuel  |
           |              |    and standby valve position    |
           |              |    indicators display BLACK and  |
           |              |    SHUT respectively when valve  |
           |              |    is open - renew Refuel Valve  |
           |              |    (55), (56), (57), (62) or     |
           |              |    (63).                         |
```


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9. Tank 9, 10, 1, 4, 5, 8, 6, 7, 2, 3, 5A or 7A refuel position indicator display is Black when valve is open - renew associated Position Indicator (80), (81), (82), (83), (84), (85), (86), (87), (88), (89), (90) or (91).
10. Tank 11 refuel position indicator display is Black when valve is open - Chart 117.

M. Press and hold the Refuel Valve Shut-off Check Test Switch (31). Check that -
(a) all 13 refuel valve position indicator displays change from yellow to black,
(b) standby inlet valve position indicator displays (panel 2-214) for tanks 10, 1, 4, 2 and 3 change from OPEN to diagonal stripes and then to SHUT,
(c) tank 11 LH trim inlet valve position indicator display (panel 5-214) changes from bar-in-line to diagonal stripes and then to bar-across-line,

NOTE: If tank 11 LH trim valve position indication faulty, refer to 28-23-00, Trouble Shooting.

(d) the SHUT 'pop-out' visual indicator on the valve is extended, and

NOTE: Tank 11 LH trim/refuel valve mechanical indicator is at SHUT.

(e) the valve is fully shut within 2 s of switch operation. IF -

OK

NOT OK

1. All 13 refuel valves do not shut when SHUT OFF CHECK test switch operated - Chart 118.
2. Tanks 9, 10, 1, 5, 6, 2, 5A and 11 refuel valves do not shut - renew LH Level Switching Pack (33).

3. Tanks 9, 10, 4, 8, 7, 3, 7A and 11 refuel valves do not shut - renew RH Level Switching Pack (34).
4. Any single valve does not shut when SHUT OFF CHECK test switch operated - Chart 119.
5. Tank 10, 1, 4, 2 or 3 single valve position indicator display is incorrect - check associated wiring for continuity and renew associated indicator (81 or 117), (82 or 118), (83 or 119), (88 or 120) or (89 or 121).
6. Tank 10, 1, 4, 2, 3 or 11 refuel valve and standby inlet valve (tank 11, LH inlet valve) position indicator displays are incorrect - check associated wiring for continuity and renew valve (55), (56), (57), (62), (63) or (66).
7. Tank 11 refuel valve position indicator display is not Black when SHUT OFF CHECK test switch is operated - Chart 120.
8. Tank 9, 5, 8, 6, 7, 5A or 7A refuel valve position indicator display is not Black when SHUT OFF CHECK test switch is operated - Chart 121.

N. Release the SHUT OFF CHECK test switch.
Check that all 13 refuel valves open.
IF -

OK

NOT OK ------ All 13 refuel valves do not re-open when SHUT OFF CHECK test switch released - Chart 122.

O. Set all 13 refuel valve switches to "SHUT". Check that all valves are shut within 2 s of switch operation. IF -

- OK — continue to P.
- NOT OK — Any single refuel valve does not shut - renew Control Switch (35), (36), (37), (38), (39), (40), (41) (42), (43), (44), (45), (46), or (47).

P. Reset master switch to "OFF DEFUEL" and close refuel panel door.

Q. Set all 9 STANDBY INLET VALVE Control Switches (108 to 116) to "OPEN". Check that, for tanks 10, 1, 4, 2 and 3, the standby inlet valve position indicator display changes from SHUT to diagonal stripes and then to OPEN, for Refuel Valves (55 to 63) the OPEN 'pop-out' indicator is extended, and the valve is fully open within 2 s of switch operation. IF -

- OK — continue.
- NOT OK —
  1. All Refuel Valves (55 to 63) do not open when standby inlet valve switches set to OPEN - check associated wiring for continuity and renew Relay (22)
  2. Any single refuel valve does not open when standby inlet valve switch at OPEN - check associated wiring for continuity and renew Control Switch (108), (109), (110), (111), (112), (113), (114), (115) or (116).

```
               |
R.*******************************************
  *Set all 9 standby valve switches to      *
  *"SHUT". Check that all valves are shut   *
  *within 2 s of switch operation.  IF -    *
  *******************************************
               |    |
               |    |         -----------------------------------
               |    |        |Renew Control Switch (108), (109),|
              OK   NOT OK----|(110), (111), (112(, (113), (114),|
               |             |(115) or (116).                   |
               |              -----------------------------------
               |
S.*******************************************
  *Open the refuel panel access door.       *
  *At fuel management panel (3CM), set tank *
  *11 LH INLET VALVE OVERRIDE switch to     *
  *"OPEN". Ensure that valve position       *
  *indicator display changes from bar-across-*
  *line to diagonal stripes and then to bar- *
  *in-line and that valve mechanical indi-   *
  *cator is at OPEN. Check, at refuel control*
  *panel, that TV OPEN caption is illuminated*
  *IF -                                      *
  *******************************************
               |    |
               |    |         -----------------------------------
               |    |        |1. Tank 11 LH inlet valve does not |
              OK   NOT OK----|   open when override switch set to|
               |             |   OPEN - refer to 28-23-00,       |
               |             |   Trouble Shooting.               |
               |             |2. TV OPEN caption is not          |
               |             |   illuminated when tank 11 LH     |
               |             |   trim/refuel valve is opened via |
               |             |   OVERRIDE control switch -       |
               |             |   Chart 123.                      |
               |              -----------------------------------
               |
T.*******************************************
  *Set tank 11 LH INLET VALVE OVERRIDE      *
  *switch to "SHUT", wait until valve is    *
  *closed and then set OVERRIDE switch to   *
  *"OFF".                                   *
  *******************************************
               |
```

```
                 |
U.******************************************
  *At fuel management panel (3CM),         *
  *individually set the following trim     *
  *inlet valve MAIN control switches to    *
  *"OPEN" and then to "AUTO": tanks 9 LH,  *
  *9 RH, 5, 7 and 11 RH. Check that as     *
  *inlet valve starts to open, the TV OPEN *
  *caption is illuminated and when valve   *
  *is shut, the TV OPEN caption is         *
  *extinguished.  IF -                     *
  ******************************************
               |    |
               |    |         ----------------------------------
               OK   NOT OK------|1. Trim inlet valve operation     |
               |                |   faulty when MAIN control switch|
               |                |   operated - refer to 28-23-00,  |
               |                |   Trouble Shooting.              |
               |                |2. TV OPEN caption is not illumi- |
               |                |   nated when tank 9 LH, 9 RH,    |
               |                |   5, 7, or 11 RH trim valve is   |
               |                |   open - check associated wiring |
               |                |   for continuity and renew       |
               |                |   associated Trim Valve (98),    |
               |                |   (99), (100), (101) or (102).   |
               |              ----------------------------------
               |
V.******************************************
  *Set LH and RH RCUs to "OPEN".  Set tank *
  *9 LH trim inlet valve MAIN control      *
  *switch to "OPEN".  Check that TV OPEN   *
  *caption is illuminated and both RCU     *
  *indicator displays change to "FAILED".  *
  *IF -                                    *
  ******************************************
               |    |
               |    |         ----------------------------------
               |    |         |Both RCUs do not display FAILED - |
               OK   NOT OK======|renew (Trim) Interlock Relay (131)|
               |              ----------------------------------
               |
W.***************************************
  *Reset both RCUs to "SHUT".           *
  ***************************************
```

4. Trouble Shooting - Load Limit Control, Operational Test

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.). *
  *Set refuel master switch to "REFUEL".    *
  *Set tanks 9 and 10 refuel valve control  *
  *switches to "OPEN"; ensure that valves   *
  *open.  Set tanks 9-10 load limit control *
  *(LLC) selector to at least 150 kg above  *
  *tank 9 contents.                         *
  *Set tanks 9-10 selector switch to "9".   *
  *Check that tanks 9 and 10 refuel valves  *
  *remain open.  IF -                       *
  *******************************************
             |    |
             |    |           ----------------------------------
             |    |          |Tank 9 refuel valve does not      |
             OK   NOT OK-----|remain open when tank 9-10        |
             |               |selector switch set to 9 - Chart  |
             |               |124.                              |
             |                ----------------------------------
             |
B.*******************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 9 contents; then *
  *increase LLC selector setting to 150 kg  *
  *above tank 9 contents.  Check that tank  *
  *9 refuel valve shuts and then re-opens   *
  *when LLC setting is within ±100 kg of    *
  *tank 9 contents.  IF -                   *
  *******************************************
             |    |
             |    |           ----------------------------------
             |    |          |Tank 9 refuel valve does not      |
             OK   NOT OK-----|shut/open when LLC setting is     |
             |               |within ±100 kg of tank 9 contents |
             |               | - Chart 125.                     |
             |                ----------------------------------
             |
 C.******************************************
   *Set LLC selector to at least 150 kg     *
   *above tank 10 contents. Set tank 9-10   *
   *selector switch to "10".  Check that    *
   *tanks 9 and 10 refuel valves remain     *
   *open.  IF -                             *
  *******************************************
             |    |
```

```
              |     |
              |     |             ----------------------------------
              |     |            |Tank 10 refuel valve does not     |
              OK    NOT OK------|remain open when tanks 9-10       |
              |                  |selector switch set to '10' -     |
              |                  |Chart 126.                        |
              |                   ----------------------------------
              |
D.*****************************************
  *Slowly reduce LLC selector setting to at*
  *least 150 kg below tank 10 contents;    *
  *then increase setting to 150 kg above   *
  *tank 10 contents.  Check that tank 10   *
  *refuel valve shuts and then re-opens    *
  *when LLC setting is within ±100 kg of   *
  *tank 10 contents.  IF -                 *
  *****************************************
              |     |
              |     |             ----------------------------------
              |     |            |Tank 10 refuel valve does not     |
              OK    NOT OK------|shut/open when LLC setting is     |
              |                  |within ±100 kg of tank 10 contents|
              |                  | - Chart 127.                     |
              |                   ----------------------------------
              |
E.*******************************************
  *Set tanks 9-10 selector switch to "OFF". *
  *Set LLC selector to "00000".  Set tank 9 *
  *and 10 refuel valve control switches to  *
  *"SHUT".  Ensure that refuel valves shut. *
  *******************************************
              |
F.*******************************************
  *Set tanks 5 and 6 refuel valve control   *
  *switches to "OPEN"; ensure that valves   *
  *are open.                                 *
  *Set tanks 5 and 6 LLC selector to at     *
  *least 150 kg above tank 5 contents.      *
  *Set tank 5-6 selector switch to "5".     *
  *Check that tanks 5 and 6 refuel valves   *
  *remain open.  IF-                        *
  *******************************************
              |     |
              |     |             ----------------------------------
              |     |            |Tank 5 refuel valve does not      |
              OK    NOT OK------|remain open when tank 5-6 selector|
              |                  |switch set to 5 - Chart 128.      |
              |                   ----------------------------------
```

```
                 |
G.*******************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 5 contents; then *
  *increase LLC selector setting to 150 kg  *
  *above tank 5 contents.  Check that tank 5*
  *refuel valve shuts and then re-opens when*
  *LLC setting is within ±100 kg of tank 5  *
  *contents.  IF -                          *
  *******************************************
                 |    |
                 |    |           ----------------------------------
                 |    |          |Tank 5 refuel valve does not shut/|
                 OK   NOT OK-----|open when LLC setting is within   |
                 |               |±100 kg of tank 5 contents. -     |
                 |               |Chart 129.                        |
                 |                ----------------------------------
                 |
H.*******************************************
  *Set LLC selector to at least 150 kg above*
  *tank 6 contents  Set tank 5-6 selector   *
  *switch to "6".  Check that tanks 5 and 6 *
  *refuel valves remain open.  IF -         *
  *******************************************
                 |    |
                 |    |           ------------------------------------
                 |    |          |Tank 6 refuel valve does not remain|
                 OK   NOT OK-----|open when tanks 5-6 selector switch|
                 |               |set to 6 - Chart 130.              |
                 |                ------------------------------------
                 |
I.*******************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 6 contents; then *
  *increase setting to 150 kg above tank 6  *
  *contents.  Check that tank 6 refuel valve*
  *shuts and then re-opens when LLC setting *
  *is within ±100 kg of tank 6 contents.    *
  *IF -                                     *
  *******************************************
                 |    |
                 |    |           -----------------------------------
                 |    |          |Tank 6 refuel valve does not shut/ |
                 OK   NOT OK-----|open when LLC setting is within    |
                 |               |±100 kg of tank 6 contents -       |
                 |               |Chart 131.                         |
                 |                -----------------------------------
                 |
```

```
J.*****************************************
  *Set tank 5-6 selector switch to "OFF".   *
  *Set LLC selector to "00000". Set tank 5  *
  *and 6 refuel valve control switches to   *
  *"SHUT". Ensure that refuel valves shut.  *
  *****************************************

K.*****************************************
  *Set tanks 8 and 7 refuel valve control   *
  *switches to "OPEN"; ensure that valves   *
  *are open. Set tank 8 and 7 LLC selector  *
  *to at least 150 kg above tank 8 contents.*
  *Set tanks 8-7 selector switch to "8".    *
  *Check that tanks 8 and 7 refuel valves   *
  *remain open.  IF -                       *
  *****************************************
                                   -------------------------------------
                                  |Tank 8 refuel valve does not remain|
             OK   NOT OK------|open when tank 8-7 selector switch |
                                  |set to 8 - Chart 132.              |
                                   -------------------------------------

L.*****************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 8 contents; then *
  *increase LLC setting to 150 kg above tank*
  *8 contents. Check that tank 8 refuel     *
  *valve shuts and then re-opens when LLC   *
  *setting is within ±100 kg of tank 8      *
  *contents.  IF -                          *
  *****************************************
                                   -------------------------------------
                                  |Tank 8 refuel valve does not shut/ |
             OK   NOT OK------|open when LLC setting is within    |
                                  |±100 kg of tank 8 contents -       |
                                  |Chart 133.                         |
                                   -------------------------------------

M.*****************************************
  *Set LLC selector to at least 150 kg above*
  *tank 7 contents.                         *
  *Set tank 8-7 selector switch to "7".     *
  *Check that tanks 8 and 7 refuel valves   *
  *remain open.  IF -                       *
  *****************************************
```

```
              |    |
              |    |         ----------------------------------
              |    |        |Tank 7 refuel valve does not remain|
              OK   NOT OK------|open when tanks 8-7 selector switch|
              |             |set to 7 - Chart 134.              |
              |              ----------------------------------
              |
N.*******************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 7 contents; then *
  *increase LLC setting to 150 kg above tank*
  *7 contents. Check that tank 7 refuel     *
  *valve shuts and then re-opens when LLC   *
  *setting is  within ±100 kg of tank 7     *
  *contents.  IF -                          *
  *******************************************
              |    |
              |    |         ----------------------------------
              |    |        |Tank 7 refuel valve does not shut/ |
              OK   NOT OK------|open when LLC setting is within   |
              |             |±100 kg of tank 7 contents -       |
              |             |Chart 135.                         |
              |              ----------------------------------
              |
O.*******************************************
  *Set tanks 8-7 selector switch to "OFF".  *
  *Set LLC selector to "00000". Set tanks 8 *
  *and 7 refuel valve control switches to   *
  *"SHUT". Ensure that refuel valves shut.  *
  *******************************************
              |
P.*******************************************
  *Set tank 11 refuel valve control switch  *
  *to "OPEN"; ensure that valve is open. Set*
  *tank 11 LLC selector to at least 150 kg  *
  *above tank 11 contents.                  *
  *Set tank 11 selector switch to "11".     *
  *Check that tank 11 refuel valve remains  *
  *open.  IF -                              *
  *******************************************
              |    |
```

```
             |    |
             |    |          ------------------------------------
             |    |         |Tank 11 refuel valve does not       |
             OK   NOT OK----|remain open when tank 11 selector   |
             |              |switch set to 11 - Chart 136.       |
             |               ------------------------------------
             |
Q.********************************************
  *Slowly reduce LLC selector setting to at *
  *least 150 kg below tank 11 contents; then*
  *increase LLC setting to 150 kg above tank*
  *11 contents. Check that tank 11 refuel   *
  *valve shuts and then re-opens when LLC   *
  *setting is within ±100 kg of tank 11     *
  *contents.  IF -                          *
  ******************************************
             |    |
             |    |          ------------------------------------
             |    |         |Tank 11 refuel valve does not shut/|
             OK   NOT OK----|open when LLC setting is within     |
             |              |±100 kg of tank 11 contents -       |
             |              |Chart 137.                          |
             |               ------------------------------------
             |
R.********************************************
  *Set tank 11 selector switch to "OFF".    *
  *Set LLC selector to "00000". Set tank 11 *
  *refuel valve control switch to "SHUT".   *
  *Ensure that valve is shut.               *
  ******************************************
```

5. Trouble Shooting - Overbalance Protection

```
A.****************************************
  *Prepare to trouble shoot (Ref. para.2.). *
  *Open refuel panel access door and set    *
  *refuel master switch to "REFUEL". Set LH *
  *and RH RCUs to "OPEN". Check that RCU    *
  *indicators display OPEN.  IF -           *
  ****************************************
             |    |
             |    |       -----------------------------------
             |    |      |Both RCU indicators display        |
            OK   NOT OK------|FAILED - check associated wiring   |
             |           |for continuity and renew Refuel    |
             |           |Master Control Switch (21).        |
             |            -----------------------------------
             |
B.****************************************
  *Set all 13 refuel valve switches to      *
  *"OPEN". Ensure that valves are open.     *
  *Monitor clearance at frame 72 safety stay*
  *and, using the jack, slowly lift the     *
  *aircraft nose until the shock absorber   *
  *strut is at full extension, i.e.,        *
  *Dimension 'D' is between 24.4 and 24.8 in*
  *(620 and 630 mm) (Ref. Weight and Balance*
  *Manual, 1-80-00, Aircraft Balance During *
  *Ground Operations). Check that as shock  *
  *absorber extends between 22.82 in        *
  *(580 mm) and 24.2 in (615 mm),           *
  *(a) the O/BALANCE caption is briefly     *
  *    illuminated and then extinguished,   *
  *(b) tanks 5A, 7A and 11 refuel valves    *
  *    shut immediately, and                *
  *(c) after a time delay of 3 s, tanks     *
  *    6, 7, 2 and 3 refuel valves close.   *
  *    IF -                                 *
  ****************************************
             |    |
             |    |       -----------------------------------
             |    |      |1. O/BALANCE caption is not briefly|
            OK   NOT OK------|   illuminated and extinguished but|
             |           |   refuel valve closings are       |
             |           |   correct - check associated      |
             |           |   wiring for continuity and renew |
             |           |   Balance Indication Relay (53).  |
```

2. O/BALANCE caption is illuminated, tanks 5A, 7A and 11 refuel valves shut, and after 5 s time delay both RCU indicators display FAILED - Chart 138.
3. O/BALANCE caption is illuminated, after 3 s time delay tanks 6, 7, 2 and 3 refuel valves shut, and after 5 s time delay (total) both RCU indicators display FAILED - Chart 139.
4. O/BALANCE caption is illuminated, refuel valves shut correctly, but after 5 s time delay both RCU indicators display FAILED - Chart 140.

C. Simulate Tank 11 Trim/refuel Valve (66) not closed, by tripping Circuit Breaker (16). Check that O/BALANCE caption is illuminated and after 5 s time delay both RCU indicators display FAILED. IF -

OK → D.

NOT OK → O/BALANCE caption not illuminated and RCU indicators display OPEN - renew Tank 11 Valve Position Relay (93).

D. Reset Circuit Breaker (16). Ensure O/BALANCE caption is extinguished. Reset RCUs to "SHUT" and then "OPEN".

E. Slowly lower aircraft until full aircraft weight is on nosewheels. Check that as shock absorber is compressed between 24.2 in (615 mm) and 22.82 in (580 mm), tanks 6,7,2,3,5A,7A and 11 refuel valves re-open. Set all refuel valve switches to "SHUT". Ensure that all valves shut.

6. Trouble Shooting - Overpressure Protection

A.**
*Prepare to trouble shoot (Ref. para.2.). *
*Ensure that refuel panel door is open, *
refuel master switch is set to REFUEL and
*both RCUs are set to OPEN. *
****

R Before SB 28-035

B.**
*NOTE: Pressure Switches (123) and (124) *
* must be tested individually. This *
* procedure details the LH system *
* with the RH system component *
* numbers in parenthesis, e.g., *
* Renew Pressure Switch (123) *
* (RH 124). *
* *
Using the fuel pressure rig, slowly apply
*a pressure of 65 psig (4.485 bar) to *
*the RCU. *
*NOTE: The associated Refuel Shut-off *
* Time Delay Relay (127) (RH 128) *
* has a time delay of 5 s before it *
* de-energizes. *
* *
*Raise the fuel pressure from 59 to 64 *
*psig (4.068 to 4.413 bar) in 1 psig *
*(0.069 bar) increments, with a delay of *
*10 s between increments. *
*NOTE: Thermal relief valves, in the *
* refuel/trim piping, allow a fuel *
* bleed of approximately 5 ml/s *
* at the above pressures. In- *
* cremental test pressure increases *
* must therefore be maintained. *
*Check that when fuel pressure is between *
*59 and 64 psig (4.068 and 4.413 bar) - *
*(a) the O/Press caption is illuminated, *
* and *
*(b) the RCU indicator displays FAILED. *
* IF - *
****

R After SB 28-035 For A/C 001-005,

B.***
*NOTE: Pressure Switches (123) and (124) *
* must be tested individually. This *
* procedure details the LH system *
* with the RH system component *
* numbers in parenthesis, e.g., *
* Renew Pressure Switch (123) *
* (RH 124). *
* *
Using the fuel pressure rig, slowly apply
*a pressure of 76 psig (5.244 bar) to *
*the RCU. *
*NOTE: The associated Refuel Shut-off *
* Time Delay Relay (127) (RH 128) *
* has a time delay of 5 s before it *
* de-energizes. *
* *
*Raise the fuel pressure from 69 to 76 *
*psig (4.761 to 5.244 bar) in 1 psig *
*(0.069 bar) increments, with a delay of *
*10 s between increments. *
*NOTE: Thermal relief valves, in the *
* refuel/trim piping, allow a fuel *
* bleed of approximately 5 ml/s *
* at the above pressures. In- *
* cremental test pressure increases *
* must therefore be maintained. *
*Check that when fuel pressure is between *
*70 and 76 psig (4.830 and 5.244 bar) - *
*(a) the O/Press caption is illuminated, *
* and *
*(b) the RCU indicator displays FAILED. *
* IF - *
****

```
        |    |
        |    |            -----------------------------------
        |    |           |1. O/PRESS caption is not illumi-  |
        OK   NOT OK------|   nated and RCU indicator does not|
        |                |   display FAILED - check          |
        |                |   associated wiring for continuity|
        |                |   and renew Pressure Switch (123) |
        |                |   (RH 124).                       |
        |                |2. O/PRESS caption is not illumi-  |
        |                |   nated but RCU indicator displays|
        |                |   FAILED - Chart 141.             |
        |                 -----------------------------------
        |
R  Before SB 28-035
        |
   C.*******************************************
     *Slowly release test pressure. As pressure*
     *drops between 59 and 54 psig (4.068      *
     *and 3.726 bar), check that O/PRESS       *
     *caption remains illuminated.  IF -       *
     *******************************************
        |

R  After SB 28-035        For A/C 001-005,

        |
   C.*******************************************
     *Slowly release test pressure. As pressure*
     *drops between 70 and 65 psig (4.830      *
     *and 4.485 bar), check that O/PRESS       *
     *caption remains illuminated.  IF -       *
     *******************************************
        |    |
        |    |            -----------------------------------
        |    |           |O/PRESS caption is extinguished    |
        OK   NOT OK------|when test pressure is released -   |
        |                |check associated wiring for        |
        |                |continuity and renew Overpressure  |
        |                |Control Relay (125) (RH 126).      |
        |                 -----------------------------------
        |
   D.*******************************************
     *Set RCU to "SHUT". Ensure that O/PRESS   *
     *caption is extinguished. Disconnect the  *
     *fuel pressure test equipment.            *
     *******************************************
```


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7. Trouble Shooting - Tank Refuelling Rate, Including High Level Shut-off and Overfull Shut-off

CAUTION: TO AVOID RISK OF AIRCRAFT OVERBALANCE DURING THIS TEST, THE AIRCRAFT ZERO FUEL C.G., AND HENCE THE FUEL LOADED C.G., MUST BE ACCURATELY DETERMINED, TANKS 2, 3, 6 AND 7 MUST BE DEFUELLED BEFORE TANK 11 IS FILLED.

A. Prepare to trouble shoot (Ref. para.2.). Refuel (Ref. 12-11-28) individually each tank to High Level Shut-off (HLSO) in the following order: tank 9, 10, 1, 4, 5, 8, 6, 7, 2, 3, 5A, 7A, 11.

Check that -

(a) individual tank refuelling rates are within the following tolerances:-

Tank	l/min	gal/min (Imp.)
9	1,259 to 1,423	277 to 313
10	1,145 to 1,291	252 to 284
1 & 4	241 to 268	53 to 59
5	600 to 673	132 to 148
8	982 to 1109	216 to 244
6	1,196 to 1,350	263 to 297
7	564 to 636	124 to 140
R 2	309 to 354	68 to 78
3	241 to 268	53 to 59
5A	264 to 300	58 to 66
7A	186 to 205	41 to 45
11	705 to 796	155 to 175

(b) and HLSO is within the tolerances of:-

Tank	Gauge kg (sp. gr. 0.790)
9	10,850 to 11,290
10	11,670 to 12,150
1 & 4	4,110 to 4,270
5	7,050 to 7,330
8	12,555 to 13,065
6	11,330 to 11,790
7	7,245 to 7,535
2 & 3	4,470 to 4,650
5A & 7A	2,180 to 2,320
11	10,180 to 10,600

```
        |      |
        |      |           -----------------------------------
        |      |          |1. Refuelling rate is not within   |
        OK    NOT OK------|   tolerances - (To be issued      |
        |                 |   later).                         |
        |                 |2. Refuel valve does not shut -    |
        |                 |   refer to 28-42-00, Trouble      |
        |                 |   Shooting.                       |
        |                  -----------------------------------
        |
B.******************************************
 *Defuel or transfer fuel out of tank 9    *
 *until the refuel valve re-opens.  Retain *
 *the refuel valve open by tripping the    *
 *valve supply CB (17); tank 10 (18),      *
 *tank 1 (6); tank 4 (8); tank 5 (10);     *
 *tank 8 (15); tank 6 (12); tank 7 (13);   *
 *tank 2 (7); tank 3 (9); tank 5A (11);    *
 *tank 7A (14); tank 11 (16).              *
 *Slowly refuel tank to overfull condition *
 *(Ref. 28-42-00, Adjustment/Test).        *
 *NOTE:  Monitor scavenge pump for start-up*
 *       during this procedure.            *
 *Check that O/FULL caption is illuminated *
 *and both RCU indicators display FAILED.  *
 *IF -                                     *
 *******************************************
        |      |
        |      |           -----------------------------------
        |      |          |If the scavenge pump is heard to   |
        OK    NOT OK------|start, and O/FULL caption is not   |
        |                 |illuminated and RCU indicators     |
        |                 |still display OPEN - refer to      |
        |                 |28-42-00, Trouble Shooting.        |
        |                  -----------------------------------
```

```
                  |
C.*******************************************
  *Reset refuel valve supply CB and ensure  *
  *that valve shuts.  Check that O/FULL     *
  *caption is extinguished.  IF -           *
  *******************************************
                  |    |
                  |    |                 ----------------------------------
                  |    |                |O/FULL caption is not extinguished|
                  OK   NOT OK------|when refuel valve is shut - refer |
                  |                     |to 28-42-00, Trouble Shooting.    |
                  |                     |NOTE:  An overfull inhibit relay  |
                  |                     |       (Q600) is associated with  |
                  |                     |       tanks 1, 2, 3 and 4. Faults|
                  |                     |       associated with this relay |
                  |                     |       are also covered in        |
                  |                     |       28-42-00.                  |
                  |                      ----------------------------------
                  |
D.*******************************************
  *Reset RCUs to open, by operating control *
  *handle to "SHUT" and then to "OPEN".     *
  *Defuel or transfer fuel until tank valve *
  *re-opens. Set refuel valve control switch*
  *to "SHUT".                               *
  *******************************************
                  |
E.*******************************************
  *Repeat tests B and C for the remaining   *
  *tanks.                                   *
  *Defuel the aircraft to maintenance/flight*
  *requirements.                            *
  *******************************************
```

```
******************************        ------------------------------
*'RE-FUEL' INDICATOR DISPLAYS *      |GROUND EQUIPMENT REQUIRED     |
*'GRD' WHEN PANEL DOOR IS SHUT*      |------------------------------|
*AND MASTER SWITCH IS AT      *      |DESCRIPTION          PART NO. |
*'OFF - DEFUEL'.              *      |------------------------------|
******************************       |GROUND POWER SUPPLY  -        |
                                     |MULTIMETER           -
                                      ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------         -------------        ----------          ----------
|Remove In- |       |With indica- |      |Check ad-  |        |*Renew    |
|dicator    |-YES-|tor removed, |-NO-|justment of|-NO-|Microswitch|
|(19). Check|       |check for    |      |Microswitch|        |(20).     |
|for contin-|       |earth at wire|      |(20). If   |         ----------
|uity       |       |terminal pin |      |necessary, |
|between    |       |Q2813A.      |      |adjust     |
|indicator  |        -------------       |microswitch|
|pins A-B.  |              |             |Is fault   |
 -----------              YES            |cleared?   |
      |                    |              ----------
      NO             --------------
      |             |With indicator |
 -----------        |removed, check |
|Renew In-  |-YES-|for 28 V d.c.  |
|dicator    |       |at wire termi- |
|(19).      |       |nal pin Q2812D.|
 -----------         --------------
                           |
                           NO
                           |
 ------------        --------------
|Renew CB    |-NO-|Check CB (2)   |
|(2).        |      |for 28 V d.c.  |
 ------------       |output.        |
                     --------------
                           |
                          YES
                           |
                     --------------
                    |*Renew Refuel  |
                    |Master Switch  |
                    |(21).          |
                     --------------
```

Chart 101

'RE-FUEL' INDICATOR DISPLAYS 'FLT' WHEN PANEL DOOR IS OPEN OPEN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Check Microswitch (20) operating lever for freedom of movement and correct adjustment. Rectify if required. Is fault cleared?

-NO- → Disconnect electrical connector from Microswitch (20). Check for O/C between connector pins D-C.

- -NO- → Renew Microswitch (20).
- YES → Renew Indicator (19).

Chart 102

```
*******************************     ------------------------------
*FQI GAUGES ARE NOT ILLUMI-   *    |GROUND EQUIPMENT REQUIRED     |
*NATED AND 'TOTAL CONTENTS'   *    |------------------------------|
*INDICATOR FAILURE FLAG IS    *    |DESCRIPTION          PART NO. |
*DISPLAYED WHEN REFUEL PANEL  *    |------------------------------|
*DOOR IS OPEN.                *    |GROUND POWER SUPPLY  -        |
*******************************    |MULTIMETER           -        |
                                    ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------         --------------------
|Disconnect electrical|-YES-|*Renew CB (1).       |
|connector from       |       --------------------
|microswitch (20).    |
|Check for continuity |
|between fixed connec-|
|tor pins G-H.        |
 --------------------
         |
         NO
         |
 --------------------
|Renew Microswitch    |
|(20).                |
 --------------------
```

Chart 103

```
**********************************
*'O/BALANCE' CAPTION IS ILLUMI-*
*NATED BEFORE 'FILAMENT TEST'  *
*SWITCH IS OPERATED, AND TEST  *
*SWITCH OPERATION HAS NO EFFECT*
*ON FILAMENTS.                 *
**********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ------------     ------------     ------------        ------------
|Check for 28|   |Check for 28|   |Remove Bal-  |      |*Renew Bal-|
|V d.c. at   |-NO-|V d.c. at  |-NO-|ance Relay   |-NO-|ance Relay |
|panel 18-123|   |panel 18-123|   |(49).Check   |      |(49).      |
|test module |   |test module |   |for contin-  |       ------------
|UT1852-12A. |   |UT1852-12C. |   |uity via     |
 ------------     ------------    |relay pins   |
      |                |          |C2-C3.       |
     YES              YES          ------------
      |                |                |
 ------------     ------------         YES
|Check ad-   |   |Check ad-   |          |
|justment and|   |justment and|     ------------
|operation of|   |operation of|    |*Renew Bal-  |
|Microswitch |   |Microswitch |    |ance Relay   |
|(52).Rectify|   |(51).Rectify|    |(48).        |
|as required.|   |as required.|     ------------
 ------------     ------------
```

Chart 104

'TV OPEN' CAPTION IS ILLUMINATED BEFORE 'FILAMENT TEST' SWITCH IS OPERATED.

GROUND EQUIPMENT REQUIRED DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Check for 28 V d.c. at panel 18-123, test module UT1852-13D.

-NO- → Disconnect electrical connector C from Trim Valves (98),(99),(100), (101 and (102). Check for O/C between fixed connector C, pin A and earth.

-NO- → Renew associated Trim Valve (98),(99),(100) (101) or (102).

YES → Renew Trim Interlock Relay (131).

Chart 105

****
*'O/PRESS' CAPTION IS *
*ILLUMINATED BEFORE 'FILAMENT *
*TEST' SWITCH IS OPERATED. *
****

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Set LH and RH RCUs (129) and (130) to "OPEN". Does LH or RH RCU indicator display FAILED?

- YES → Check for 28 V d.c. at associated LH panel 15-123, test module UT1851-9C or RH panel 18-123, test module UT1852-13A.
  - YES → Renew associated Refuel Protection Pressure Switch (123) or (124).
- NO → Remove LH Over-pressure Control Relay (125). Check relay for O/C between pins A2-A1.
  - YES → Renew Over-pressure Control Relay (126).
  - NO → *Renew Overpressure Control Relay (125).

Chart 106

```
********************************
*REFUEL PANEL CAPTIONS ARE NOT*
*ILLUMINATED WHEN 'FILAMENT   *
*TEST' SWITCH OPERATED.       *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------        ----------------
|Press FQI TEST      |      |*Renew Ground/  |
|switch. Do FQIs     |-NO-|Flight Relay     |
|show increase in    |      |(22).           |
|quantity displayed? |       ----------------
 --------------------
         |
        YES
         |
 --------------------
|*Renew Filament Test|
|Switch (27).        |
 --------------------
```

Chart 107

BOTH RCU INDICATORS DISPLAYS 'FAILED' WHEN MASTER SWITCH AT 'OFF DEFUEL'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------------        -----------------          -----------------
|Remove Trim      |      |Disconnect       |        |Trouble shoot    |
|Interlock Relay  |-YES-|electrical con-   |-NO-|tank o/full        |
|(131). Check for |      |nector at RCUs.  |        |circuits and     |
|continuity be-   |      |Check for 28 V   |        |Level Switching  |
|tween relay pins |      |d.c. at free con-|        |Pack (33).(Ref.  |
|A2-A3.           |      |nector pin C.    |        |28-42-00, Trouble|
 -----------------        -----------------         |Shooting).       |
        |                        |                   -----------------
        NO                       |
        |                       YES
 -----------------               |
|Renew Trim       |       -----------------
|Interlock Relay  |      |*Renew Refuel    |
|(131).           |      |Master Switch    |
 -----------------       |(21).            |
                          -----------------
```

Chart 108

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LH OR RH RCU INDICATOR DISPLAYS 'FAILED' WHEN MASTER SWITCH AT 'OFF DEFUEL'

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Disconnect electrical connector at associated Pressure Switch (123) or (124). Check continuity between fixed connector pins A-C.
- YES: Check for 28 V d.c. at panel 15-123, test module UT1851-9A (LH), or panel 18-123, test module UT1852-14A (RH).
  - YES: Disconnect electrical connector at RCU (129) or (130). Check for 28 V d.c. at free connector pin A.
    - YES: *Renew RCU (129) or (130).
    - NO: *Renew Time Delay Relay (127) or (128).
  - NO: Disconnect electrical connector at RCU (129) or (130). Check continuity between fixed connector pins C-D.
    - YES: *Renew Over-Pressure Control Relay (125) or (126).
    - NO: Renew RCU (129) or (130).
- NO: Renew Pressure Switch (123) or (124).

Chart 109

'PRV' CAPTION IS NOT ILLUMINATED AND FQI FAILURE FLAGS ARE NOT WITHDRAWN WHEN MASTER SWITCH AT 'SET UP'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------          ----------------
|Remove Ground/Flight|        |*Renew Refuel   |
|Relay (22). Check   |-NO-    |Master Switch   |
|for 28 V d.c. at    |        |(21).           |
|relay socket pin A1.|         ----------------
 --------------------
          |
         YES
          |
 --------------------
|*Renew Ground/Flight|
|Relay (22).         |
 --------------------
```

Chart 110

```
*******************************
*ANY SINGLE RCU INDICATOR DOES*
*NOT DISPLAY 'FAILED' WHEN    *
*MASTER SWITCH SET TO 'SET UP'*
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 --------------------          ---------------
|Disconnect electrical|-YES-|Renew RCU (129) |
|connector at RCU.    |     |or (130).       |
|Check for 0 V at free|      ---------------
|connector, pin A.    |
 --------------------
         |
         NO
         |
 --------------------
|Renew Time Delay     |
|Relay (127) or (128).|
 --------------------
```

Chart 111

```
*******************************
*TANKS 6, 7, 2 AND 3 REFUEL   *
*VALVES DO NOT OPEN AND       *
*'O/BALANCE' CAPTION IS NOT   *
*ILLUMINATED.                 *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------        ---------------
|Remove Balance Relay|-YES-|*Renew Refuel   |
|(49). Check for     |     |Time Delay Relay|
|continuity between  |     |(50).           |
|relay pins A2-A3.   |      ---------------
 --------------------
          |
          NO
          |
 --------------------
|Renew Balance Relay |
|(49).               |
 --------------------
```

Chart 112

TANK 1, 4, 2, 3, 5A OR 7A REFUEL VALVE DOES NOT OPEN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check for 28 V d.c. at test module terminal:-

Tank	Panel
1	15-123, UT1851-7C;
4	18-123, UT1852-8C;
2	15-123, UT1851-7A;
3	18-123, UT1852-8A;
5A	15-123, UT1851-6C;
7A	18-123, UT1852-7C.

- NO → *Renew Valve Control Switch (37), (38),(43), (44),(45) or (46).
- YES → Disconnect electrical connector at Valve (56), (57),(62),(63), (64) or (65). Check for 28 V d.c. at free connector pin B.
  - NO → back to "Check for 28 V d.c. at test module terminal" (see above).
  - YES → *Renew Refuel Valve (56),(57), (62),(63),(64) or (65).

Check for 'earth' at test module terminal:-

Tank	Panel
1	15-123, UT1851-7D;
4	18-123, UT1852-8D;
2	15-123, UT1851-7B;
3	18-123, UT1852-8B;
5A	15-123, UT1851-6D;
7A	18-123, UT1852-7D;

- NO → Trouble shoot earth return circuit for high level switching in LH Level Switching Pack (33), or RH Level Switching Pack (34) (Ref. 28-42-00, Trouble Shooting).
- YES →

Continued on Sheet 2

Chart 113 (Sheet 1 of 2)

Continued from Sheet 1

```
                    |
 -----------------------------              ------------
|Remove Valve Control Relay |           |*Renew CB     |
|(69),(70),(75),(76),(77) or|-NO-|(6),(8),(7),|
|(78). Check for 28 V d.c.  |           |(9),(11), or|
|at relay socket pin A2.    |           |(14).         |
 -----------------------------              ------------
                  |
                 YES
                  |
 -----------------------------
|*Renew Valve Control Relay |
|(69),(70),(75),(76),(77) or|
|(78).                      |
 -----------------------------
```

Chart 113 (Sheet 2 of 2)

TANK 9, 10, 5, 8, 6, OR 7 REFUEL VALVE DOES NOT OPEN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Disconnect electrical connector at Valve (54), (55),(58),(59), (60) or (61). Check for 28 V d.c. at free connector pin B.

- YES — Continued on Sheet 2
- NO — Check for 28 V d.c. at test module terminal:-

Tank	Panel
9	- 18-123, UT1852-11A;
10	- 18-123, UT1852-10A;
5	- 15-123, UT1851-8C;
8	- 18-123, UT1852-9A;
6	- 15-123, UT1851-8A;
7	- 18-123, UT1852-9C.

- YES — Continued on Sheet 2
- NO — Check for 28 V d.c. at Valve Control Switch (35),(36), (39),(40), (41) or (42) terminal 2 (Before SB 28-023) or terminal 1 (After SB 28-023).
  - YES — Continued on Sheet 2
  - NO — Continued on Sheet 2

Continued on Sheet 2

Chart 114 (Sheet 1 of 2)

Continued from Sheet 1

*Renew Refuel Valve (54),(55), (58),(59),(60) or (61).

Check for 'earth' at test module terminal:-

Tank		Panel
9	-	18-123, UT1852-11D;
10	-	18-123, UT1852-10B;
5	-	15-123, UT1851-8D;
8	-	18-123, UT1852-9B;
6	-	15-123, UT1851-8B;
7	-	18-123, UT1852-9D.

Renew Valve Control Switch (35), (36), (39), (40),(41) or (42).

Remove Valve Control Relay (67), (68),(71),(72), (73),or (74). Check for 28 V d.c. at relay socket pin A2. -YES-

*Renew Tank Selector Switch (94), (95) or (96).

NO

YES

NO

*Renew Valve Control Relay (67),(68), (71),(72), (73) or (74).

*Renew CB (17),(18), (10), (15),(12), or (13).

Trouble shoot earth return circuit for high level switching in LH Level Switching Pack (33) or RH Level Switching Pack (34) (Ref. 28-42-00, Trouble Shooting).

Chart 114 (Sheet 2 of 2)

TANK 11 TRIM/REFUEL VALVE DOES NOT OPEN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Close refuel panel door and check for satisfactory operation of tank 11 LH INLET VALVE via its MAIN control switch. Is operation satisfactory?

- YES: Remove C/O Relay (132). Check for 28 V d.c. at relay socket A1.
  - YES: *Renew C/O Relay (132).
  - NO: Check for 28 V d.c. at Valve Control Switch (47), terminal 2 (Before SB 28-023) or terminal 1 (After SB 28-023).
    - YES: *Renew Tank 11 Selector Switch (97).
    - NO: *Renew Valve Control Switch (47).
- NO: Refer to 28-23-00, Trouble Shooting.

Chart 115

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TANK 10, 1, 4, 2 OR 3 STANDBY INLET VALVE INDICATOR DOES NOT DISPLAY 'OPEN' WHEN ASSOCIATED VALVE IS OPEN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Disconnect electrical connector at Refuel Valve (55),(56),(57), (62) or (63). Check for continuity between fixed connector pins B-D.	-YES-	*Renew Standby Inlet Valve Indicator (117), (118), (119), (120) or (121).
NO		
Renew Refuel Valve (55), (56), (57), (62) or (63).		

Chart 116

```
*******************************      --------------------------------
*TANK 11 REFUEL POSITION      *     |GROUND EQUIPMENT REQUIRED       |
*INDICATOR DISPLAY IS BLACK   *     |--------------------------------|
*WHEN VALVE IS OPEN.          *     |DESCRIPTION            PART NO. |
*******************************     |--------------------------------|
                                    |GROUND POWER SUPPLY   -         |
                                    |MULTIMETER            -         |
                                     --------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ---------------       ----------------------        --------------
|Check for 28 V |     |Disconnect electrical |      |Renew Valve   |
|d.c. supply to |-YES-|connectors C and B    |-YES-|Position Relay|
|Position Indi- |     |from Trim/Refuel Valve|      |(93).         |
|cator (92) pin |     |(66). Check for O/C   |       --------------
|A.             |     |between fixed con-    |
 ---------------      |ectors C, pin C, and  |
       |              |B, pin A.             |
       NO              ----------------------
       |                         |
 ---------------                 NO
|Renew Position |                |
|Indicator (92).|      ----------------------
 ---------------      |Renew Trim/Refuel     |
                      |Valve (66).           |
                       ----------------------
```

Chart 117

```
********************************
*ALL 13 REFUEL VALVES DO NOT   *
*SHUT WHEN 'SHUT OFF CHECK'    *
*TEST SWITCH OPERATED.         *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

<u>NOTE</u>: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------       -----------         -----------        -----------
|Check for  |     |With switch|       |Earth test |      |*Renew Test|
|28 V d.c.  |-YES-|released,  |-YES-  |switch 28 V|-YES- |Switch     |
|at panel   |     |check for  |       |supply at  |      |(31).      |
|18-123,    |     |28 V d.c.  |       |terminal 1.|       -----------
|test module|     |supply to  |       |Have refuel|
|UT-1852-14C|     |Shut-off   |       |valves     |
 -----------      |Check Test |       |shut?      |
      |           |Switch (31)|        -----------
      |           |terminal 1.|             |
      |            -----------              |
      NO                |                   |
      |                 NO                  |
      |                 |                   |
      |            -----------              NO
 -----------      |*Renew     |             |
|*Renew     |     |Control    |        -----------
|Refuel     |     |Relay (32).|       |*Renew     |
|Master     |      -----------        |Control    |
|Switch     |                         |Relay (32).|
|(21).      |                          -----------
 -----------
```

Chart 118

ANY SINGLE VALVE DOES NOT SHUT WHEN 'SHUT OFF CHECK' TEST SWITCH OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check for 28 V d.c. at test module terminal:-

Tank	Panel
9	18-123, UT1852-11D;
10	18-123, UT1852-10B;
1	15-123, UT1851-7D;
4	18-123, UT1852-8D;
5	15-123, UT1851-8D;
8	18-123, UT1852-9B;
6	15-123, UT1851-8B;
7	18-123, UT1852-9D;
2	15-123, UT1851-7B;
3	18-123, UT1852-8B;
5A	15-123, UT1851-6D;
7A	18-123, UT1852-7D;
11	15-123, UT1851-5D.

- YES → *Renew asscoiated Valve Control Relay (67 to 79).
- NO → Disconnect electrical connector at associated Re-fuel Valve (54 to 65); if tank 11, disconnect connector A at Valve (66). Check for 28 V d.c. at free connector pin C.
  - YES → *Renew associated Valve (54 to 66).
  - NO → Trouble shoot earth return circuit for high level switching in LH Level Switching Pack (33) or RH Level Switching Pack (34), (Ref. 28-42-00, Trouble Shooting).

Chart 119

```
********************************
*TANK 11 REFUEL VALVE POSITION*
*INDICATOR DISPLAY IS NOT     *
*BLACK WHEN 'SHUT OFF CHECK'  *
*TEST SWITCH IS OPERATED.     *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -------------------       -------------------
|Check for 28 V d.c.|     |*Renew Valve       |
|supply to Indicator|-NO-|Position Relay     |
|(92) at terminal A.|     |(93).              |
 -------------------       -------------------
         |
        YES
         |
 -------------------
|Renew Position     |
|Indicator (92).    |
 -------------------
```

Chart 120

****
*TANK 9, 5, 8, 6, 7, 5A OR 7A *
*REFUEL VALVE POSITION INDI- *
*CATOR DISPLAY IS NOT BLACK *
*WHEN 'SHUT OFF CHECK' TEST *
*SWITCH IS OPERATED. *
****

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------       ---------------------
|Check for 28 V d.c. |     |*Renew Refuel Valve |
|supply to Position  |-NO-|(54), (58), (59),   |
|Indicator (80),(84),|     |(60), (61), (64) or |
|(85),(86),(87),(90) |     |(65).               |
|or (91) at terminal |      ---------------------
|A.                  |
 --------------------
          |
         YES
          |
 --------------------
|*Renew Position     |
|Indicator (80),     |
|(84), (85), (86),   |
|(87), (90) or (91). |
 --------------------
```

Chart 121

```
*******************************
*ALL 13 REFUEL VALVES DO NOT   *
*RE-OPEN WHEN 'SHUT OFF CHECK' *
*TEST SWITCH RELEASED.         *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 -------------------        -------------------
|Remove Shut-off    |      |Renew Shut-off Check|
|Control Relay (32).|-YES-|Test Switch (31).   |
|Check relay for O/C|       -------------------
|between pins A2-A1.|
 -------------------
         |
         NO
         |
 -------------------
|Renew Control Relay|
|(32).              |
 -------------------
```

Chart 122

```
*******************************
*'TV OPEN' CAPTION IS NOT     *
*ILLUMINATED WHEN TANK 11 LH  *
*TRIM/REFUEL VALVE IS OPENED  *
*VIA 'OVERRIDE' CONTROL       *
*SWITCH.                      *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------         --------------------          ------------
|Disconnect electri- |       |Check for 28 V d.c. |        |*Renew Trim/|
|cal connector C from|-NO-   |at panel 18-123,    |-YES-   |Refuel Valve|
|Trim/Refuel Valve   |       |test module UT1852- |        |Interlock   |
|(66). Check for 28 V|       |13D.                |        |Relay (103).|
|d.c. at free        |        --------------------          ------------
|connector C pin A.  |                 |
 --------------------                  NO
         |                             |
        YES                   --------------------
         |                   |*Renew Trim         |
         |                   |Interlock Relay     |
         |                   |(131).              |
         |                    --------------------
 -------------------
|Check for earth at |
|fixed connector    |         --------------------
|C pin A.           |-YES-   |*Renew Trim         |
 -------------------         |Interlock Relay     |
         |                   |(131).              |
        NO                    --------------------
         |
 -------------------
|*Renew Trim/Refuel |
|Valve (66).        |
 -------------------
```

Chart 123

TANK 9 REFUEL VALVE DOES NOT REMAIN OPEN WHEN TANK 9-10 SELECTOR SWITCH SET TO '9'.

GROUND EQUIPMENT REQUIRED

DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check tank 9-10 Selector Switch (94) for continuity between terminals 2-3.

- YES → Disconnect electrical connector at Selector (104). Check free connector for a.c. voltage between pins C-A.
  - NO → *Renew LH Level Switching Pack (33).
- NO → Renew Selector Switch (94).

Chart 124

TANK 9 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 9 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Set LLC to 150 kg above tank 10 contents. Set tank 9-10 selector switch to "10". Reduce LLC setting to 150 kg below tank 10 contents; then increase LLC setting to 150 kg above tank 10 contents. Is fault the same?

- NO → *Renew Tank 9 Contents Indicator (133). Is fault cleared?
  - NO → *Renew Main CG Pack (23).
- YES → *Renew Load Limit Control Selector (104). Is fault cleared?
  - NO → *Renew LH Level Switching Pack (33).

Chart 125

****
TANK 10 REFUEL VALVE DOES NOT
*REMAIN OPEN WHEN TANK 9-10   *
*SELECTOR SWITCH SET TO '10'. *
****

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

*Renew Selector Switch (94). Is fault cleared?	-NO-	*Renew LH Level Switching Pack (33).

Chart 126

```
********************************
*TANK 10 REFUEL VALVE DOES NOT*
*SHUT/OPEN WHEN LLC SETTING IS*
*WITHIN ±100 kg OF TANK 10    *
*CONTENTS.                    *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------       ------------------
|*Renew Tank 10      |     |*Renew Main CG    |
|Contents Indicator  |-NO-|Pack (23).        |
|(134). Is fault     |      ==================
|cleared?            |
 --------------------
```

Chart 127

```
*******************************
*TANK 5 REFUEL VALVE DOES NOT *
*REMAIN OPEN WHEN TANK 5-6    *
*SELECTOR SWITCH SET TO '5'.  *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------          ----------------          ----------------
|Check tank 5-6  |        |Disconnect      |        |*Renew LH Level |
|Selector Switch |-YES-   |electrical      |--NO-   |Switching Pack  |
|(95) for continu-|       |connector at    |        |(33).           |
|ity between     |        |Selector (105). |         ----------------
|terminals 4-5.  |        |Check free      |
 ----------------         |connector for   |
        |                 |a.c. voltage    |
        NO                |between pins C-A.|
        |                  ----------------
 ----------------
|Renew Selector  |
|Switch (95).    |
 ----------------
```

Chart 128

TANK 5 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 5 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

- Set LLC to 150 kg above tank 6 contents. Set tank 5-6 selector switch to "6". Reduce LLC setting to 150 kg below tank 6 contents; then increase LLC setting to 150 kg above tank 6 contents. Is fault the same?
  - NO → *Renew Tank 5 Contents Indicator (135). Is fault cleared?
    - NO → *Renew Main CG Pack (23).
  - YES → *Renew Load Limit Control Selector (105). Is fault cleared?
    - NO → *Renew LH Level Switching Pack (33).

Chart 129

```
********************************
*TANK 6 REFUEL VALVE DOES NOT *
*REMAIN OPEN WHEN TANK 5-6    *
*SELECTOR SWITCH SET TO '6'.  *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------           ----------------
|*Renew Selector  |        |*Renew LH Level  |
|Switch (95). Is  |--NO-|Switching Pack  |
|fault cleared?   |        |(33).            |
 ----------------           ----------------
```

Chart 130

TANK 6 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 6 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

*Renew Tank 6 Contents Indicator (136). Is fault cleared?	-NO-	*Renew Main CG Pack (23).

Chart 131

```
*******************************        --------------------------------
*TANK 8 REFUEL VALVE DOES NOT *       |GROUND EQUIPMENT REQUIRED       |
*REMAIN OPEN WHEN TANK 8-7    *       |--------------------------------|
*SELECTOR SWITCH SET TO '8'.  *       |DESCRIPTION           PART NO.  |
*******************************       |--------------------------------|
                                      |GROUND POWER SUPPLY   -         |
                                      |MULTIMETER            -         |
                                       --------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------------        -----------------
|Check Tank 8-7   |      |Disconnect       |
|Selector Switch  |-YES-|electrical       |
|(96) for         |      |connector at     |
|continuity be-   |      |Selector (106).  |
|tween terminals  |      |Check free       |
|2-3.             |      |connector for    |
 -----------------       |a.c. voltage be- |
         |               |between pins C-A.|
         NO                -----------------
         |
 -----------------                |
|Renew Selector   |               NO
|Switch (96).     |               |
 -----------------        -----------------
                         |*Renew RH Level  |
                         |Switching Pack   |
                         |(34).            |
                          -----------------
```

Chart 132

TANK 8 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 8 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

1. Set LLC to 150 kg above tank 7 contents. Set tank 8-7 selector switch to "7". Reduce LLC setting to 150 kg below tank 7 contents; then increase LLC setting to 150 kg above tank 7 contents. Is fault the same?
   - NO → *Renew Tank 8 Contents Indicator (137). Is fault cleared?
     - NO → *Renew Main CG Pack (23).
   - YES → *Renew Load Limit Control Selector (106). Is fault cleared?
     - NO → *Renew RH Level Switching Pack (34).

Chart 133

```
********************************
*TANK 7 REFUEL VALVE DOES NOT  *
*REMAIN OPEN WHEN TANK 8-7     *
*SELECTOR SWITCH SET TO '7'.   *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------------         -----------------
|*Renew Load Limit|-NO--|*Renew RH Level   |
|Control Selector |     |Switching Pack    |
|(106). Is fault  |     |(34).             |
|cleared?         |      -----------------
 -----------------
```

Chart 134

TANK 7 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 7 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

*Renew Tank 7 Contents Indicator (138). Is fault cleared?	-NO-	*Renew Main CG Pack (23).

Chart 135

TANK 11 REFUEL VALVE DOES NOT REMAIN OPEN WHEN TANK 11 SELECTOR SWITCH SET TO '11'.

GROUND EQUIPMENT REQUIRED

DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check Tank 11 Selector Switch (97) for continuity between terminals 1-2.

- YES → Disconnect electrical connector at Selector (107). Check free connector for a.c. voltage between pins C-A.
  - NO → Renew RH Level Switching Pack (34).
- NO → Renew Selector Switch (97).

Chart 136

TANK 11 REFUEL VALVE DOES NOT SHUT/OPEN WHEN LLC SETTING IS WITHIN ±100 kg OF TANK 11 CONTENTS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Disconnect electrical connector at LLC Selector (107). Check for continuity between fixed connector pins A-C and and A-B.

- NO → Renew Tank 11 LLC Selector (107).
- YES → Disconnect electrical connector at Tank 11 Contents Indicator (139). Check for continuity between fixed connector pins G-J and G-H.
  - NO → Renew Tank 11 Contents Indicator (139).
  - YES → *Renew Main CG Pack (23). Is fault cleared?
    - NO → *Renew RH Level Switching Pack (34).

Chart 137

```
********************************
*'O/BALANCE' CAPTION IS        *
*ILLUMINATED, TANKS 5A, 7A AND*
*11 REFUEL VALVES SHUT AND     *
*AFTER 5 s TIME DELAY BOTH     *
*RCU INDICATORS DISPLAY        *
*'FAILED'                      *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 --------------------          --------------------
|Check for 28 V d.c. |        |*Renew Balance Relay |
|at panel 18-123,    |-YES-|(49).                |
|test module UT1852- |        --------------------
|12A.                |
 --------------------
         |
         NO
         |
 --------------------
|*Renew Nose Gear    |
|Weight Microswitch  |
|(52).               |
 --------------------
```

Chart 138

'O/BALANCE' CAPTION IS ILLUMINATED, AFTER 3 s TIME DELAY TANKS 6, 7, 2 AND 3 REFUEL VALVES SHUT, AND AFTER 5 s TIME DELAY (TOTAL) BOTH RCU INDICATORS DISPLAY 'FAILED'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

Check for 28 V d.c. at panel 18-123, test module UT1852-12C.

- YES → *Renew Balance Relay (48).
- NO → *Renew Nose Gear Weight Microswitch (51).

Chart 139

```
*********************************
*'O/BALANCE' CAPTION IS         *
*ILLUMINATED, REFUEL VALVES     *
*SHUT CORRECTLY, BUT AFTER 5 s*
*TIME DELAY BOTH RCU            *
*INDICATORS DISPLAY 'FAILED'. *
*********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ---------------------        ---------------------        ------------
|Remove Balance Relay|      |Remove Tank 11 Valve|      |*Renew     |
|(48). Check for 28 V|--NO-|Position Relay (93).|-NO-|Balance    |
|d.c. at relay       |      |Check for 28 V d.c. |      |Relay (49). |
|socket pin C1.      |      |at relay socket pin |       ------------
 ---------------------       |A2.                 |
           |                  ---------------------
          YES                           |
           |                           YES
 ---------------------                  |
|*Renew Balance      |        ---------------------
|Relay (48).         |       |*Renew Tank 11 Valve|
 ---------------------       |Position Relay (93).|
                              ---------------------
```

Chart 140

'O/PRESS' CAPTION IS NOT ILLUMINATED BUT RCU INDICATOR DISPLAYs 'FAILED'.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

With test pressure maintained, check for 28 V d.c. at panel 15-123, test module UT1851-9C (RH Panel 18-123, test module UT1852-13A).

- YES: *Renew Over-pressure Control Relay (125) (RH 126).
- NO: With test pressure maintained, disconnect electrical connector from Pressure Switch (123) (RH 124). Check fixed connector for continuity between pins A-B.
  - YES: *Renew Refuel Shut-off Time Delay Relay (127) (RH 128).
  - NO: Renew Pressure Switch (123) (RH 124).

Chart 141

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1) Circuit breaker 115 V	-	25-216	Q635	Map ref.B8	24-50-00 R/I	28-24-01
(2) Circuit breaker 28 V	-	15-215	Q513	Map ref.E20	24-50-00 R/I	28-24-01
(3) Circuit breaker 28 V	-	15-216	Q1217	Map ref.F8	24-50-00 R/I	28-24-01
(4) Circuit breaker 28 V	-	15-215	Q1218	Map ref.D19	24-50-00 R/I	28-24-01
(5) Circuit breaker 28 V	-	15-215	Q511	Map ref.E19	24-50-00 R/I	28-24-02
(6) Circuit breaker 28 V	-	15-215	Q522	Map ref.E23	24-50-00 R/I	28-24-03
(7) Circuit breaker 28 V	-	15-216	Q524	Map ref.F10	24-50-00 R/I	28-24-03
(8) Circuit breaker 28 V	-	15-215	Q521	Map ref.E24	24-50-00 R/I	28-24-04
(9) Circuit breaker 28 V	-	15-216	Q523	Map ref.F3	24-50-00 R/I	28-24-04
(10) Circuit breaker 28 V	-	15-215	Q518	Map ref.E25	24-50-00 R/I	28-24-05
(11) Circuit breaker 28 V	-	15-216	Q526	Map ref.F4	24-50-00 R/I	28-24-05
(12) Circuit breaker 28 V	-	15-215	Q520	Map ref.F20	24-50-00 R/I	28-24-05
(13) Circuit breaker 28 V	-	15-215	Q517	Map ref.F21	24-50-00 R/I	28-24-06
(14) Circuit breaker 28 V	-	15-216	Q525	Map ref.F5	24-50-00 R/I	28-24-06
(15) Circuit breaker 28 V	-	15-215	Q519	Map ref.F19	24-50-00 R/I	28-24-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(16) Circuit breaker 28 V	-	15-215	Q365	Map ref.G21	24-50-00 R/I	28-23-07
(17) Circuit breaker 28 V	-	15-216	Q515	Map ref.F9	24-50-00 R/I	28-24-07
(18) Circuit breaker 28 V	-	15-215	Q516	Map ref.E22	24-50-00 R/I	28-24-08
(19) Refuel door position indicator	-	2-214	Q659	Fuel management panel (3CM)	28-00-00 R/I	28-24-01
(20) Refuel door operated microswitch	-	1-194	Q548	Refuel control panel	28-24-61 R/I, A/T	28-24-01
(21) Refuel master switch	-	1-194	Q549	Refuel control panel	28-00-00 R/I	28-24-01
(22) Ground/ flight relay	-	18-123	Q599	RH fuel relay box fwd. underfloor racking	28-00-00 R/I	28-24-01
(23) Main CG pack	-	2-216	Q1343	3CM station	28-44-81 R/I	28-44-06
(24) Quantity pack A	-	9-216	Q1342	3CM station	28-44-92 R/I	28-44-01
(25) Quantity pack B	-	10-216	Q1341	3CM station	28-44-92 R/I	28-44-01
(26) FQI test switch	-	1-194	Q1074	Refuel Control panel	28-44-00 R/I	28-44-01
(27) Filament test switch	-	1-194	Q653	Refuel control panel	28-00-00 R/I	28-24-01
(28) TV OPEN	-	1-194	Q542	Refuel	28-00-00	28-24-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
caption light module				control panel	R/I	
(29) O/PRESS caption light module	-	1-194	Q544	Refuel control panel	28-00-00 R/I	28-24-01
(30) O/BALANCE caption light module	-	1-194	Q543	Refuel control panel	28-00-00 R/I	28-24-01
(31) Refuel valve 'shut-off check' test switch	-	1-194	Q636	Refuel control panel	28-00-00 R/I	28-24-01
(32) Refuel valve shut-off control relay	-	18-123	Q604	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-01
(33) LH level switching pack	-	10-216	Q1350	3CM station	28-42-51 R/I	28-42-05
(34) RH level switching pack	-	2-216	Q1351	3CM station	28-42-51 R/I	28-42-07
(35) Tank 9 refuel valve control switch	-	1-194	Q565	Refuel control panel	28-00-00 R/I	28-24-07
(36) Tank 10 refuel valve control switch	-	1-194	Q566	Refuel control panel	28-00-00 R/I	28-24-08
(37) Tank 1 refuel valve control switch	-	1-194	Q561	Refuel control panel	28-00-00 R/I	28-24-03
(38) Tank 4 refuel valve control switch	-	1-194	Q562	Refuel control panel	28-00-00 R/I	28-24-04

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(39) Tank 5 refuel valve control switch	-	1-194	Q563	Refuel control panel	28-00-00 R/I	28-24-05
(40) Tank 8 refuel valve control switch	-	1-194	Q564	Refuel control panel	28-00-00 R/I	28-24-06
(41) Tank 6 refuel valve control switch	-	1-194	Q556	Refuel control panel	28-00-00 R/I	28-24-05
(42) Tank 7 refuel valve control switch	-	1-194	Q557	Refuel control panel	28-00-00 R/I	28-24-06
(43) Tank 2 refuel valve control switch	-	1-194	Q554	Refuel control panel	28-00-00 R/I	28-24-03
(44) Tank 3 refuel valve control switch	-	1-194	Q555	Refuel control panel	28-00-00 R/I	28-24-04
(45) Tank 5A refuel valve control switch	-	1-194	Q558	Refuel control panel	28-00-00 R/I	28-24-05
(46) Tank 7A refuel valve control switch	-	1-194	Q560	Refuel control panel	28-00-00 R/I	28-24-06
(47) Tank 11 trim/refuel valve control switch	-	1-194	Q559	Refuel control panel	28-00-00 R/I	28-24-07
(48) Balance relay	-	18-123	Q598	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(49) Balance relay	-	18-123	Q597	RH fuel relay box,	28-00-00 R/I	28-24-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				fwd. underfloor racking		
(50) Refuel time delay relay	-	18-123	Q601	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-01
(51) Nose gear weight micro-switch	-	715	G321	Nose gear	32-31-96 R/I, A/T	32-61-06
(52) Nose gear weight micro-switch	-	715	G320	Nose gear	32-31-96 R/I, A/T	32-61-06
(53) Balance indication relay	-	18-123	Q581	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(54) Tank 9 refuel valve	191 MB	-	Q618	In tank 10	28-24-12 R/I	28-24-07
(55) Tank 10 refuel valve	192 MB	-	Q619	In tank 10	28-24-12 R/I	28-24-08
(56) Tank 1 refuel valve	193 DB	-	Q625	In tank 1	28-24-12 R/I	28-24-03
(57) Tank 4 refuel valve	194 DB	-	Q624	In tank 4	28-24-12 R/I	28-24-04
(58) Tank 5 refuel valve	193 GB	-	Q621	In tank 5	28-24-12 R/I	28-24-05
(59) Tank 8 refuel valve	194 MB	-	Q622	In tank 8	28-24-12 R/I	28-24-06
(60) Tank 6 refuel valve	195 DB	-	Q623	In tank 6	28-24-12 R/I	28-24-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(61) Tank 7 refuel valve	196 DB	-	Q620	In tank 7	28-24-11 R/I	28-24-06
(62) Tank 2 refuel valve	197 EB	-	Q627	In tank 2	28-24-11 R/I	28-24-03
(63) Tank 3 refuel valve	198 EB	-	Q626	In tank 3	28-24-11 R/I	28-24-04
(64) Tank 5A refuel valve	532 AT	-	Q629	In tank 6	28-24-11 R/I	28-24-05
(65) Tank 7A refuel valve	632 AT	-	Q628	In tank 7	28-24-11 R/I	28-24-06
(66) Tank 11 trim/refuel valve	752	-	Q407	In tank 11	28-23-21 R/I	28-23-07
(67) Tank 9 valve control relay	-	18-123	Q585	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-07
(68) Tank 10 valve control relay	-	18-123	Q586	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-08
(69) Tank 1 valve control relay	-	15-123	Q592	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-03
(70) Tank 4 valve control relay	-	18-123	Q591	RH fuel relay box fwd. underfloor racking	28-00-00 R/I	28-24-04
(71) Tank 5 valve control	-	15-123	Q588	LH fuel relay box,	28-00-00 R/I	28-24-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
relay				fwd. underfloor racking		
(72) Tank 8 valve control relay	-	18-123	Q589	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-06
(73) Tank 6 valve control relay	-	15-123	Q590	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-05
(74) Tank 7 valve control relay	-	18-123	Q587	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-06
(75) Tank 2 valve control relay	-	15-123	Q594	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-03
(76) Tank 3 valve control relay	-	18-123	Q593	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-04
(77) Tank 5A valve control relay	-	15-123	Q595	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-05
(78) Tank 7A valve control relay	-	18-123	Q596	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-06

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(79) Tank 11 valve control relay	-	15-123	Q399	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-23-07
(80) Tank 9 valve position indicator	-	1-194	Q528	Refuel control panel	28-00-00 R/I	28-24-07
(81) Tank 10 valve position indicator	-	1-194	Q529	Refuel control panel	28-00-00 R/I	28-24-08
(82) Tank 1 valve position indicator	-	1-194	Q535	Refuel control panel	28-00-00 R/I	28-24-03
(83) Tank 4 valve position indicator	-	1-194	Q534	Refuel control panel	28-00-00 R/I	28-24-04
(84) Tank 5 valve position indicator	-	1-194	Q531	Refuel control panel	28-00-00 R/I	28-24-05
(85) Tank 8 valve position indicator	-	1-194	Q532	Refuel control panel	28-00-00 R/I	28-24-06
(86) Tank 6 valve position indicator	-	1-194	Q533	Refuel control panel	28-00-00 R/I	28-24-05
(87) Tank 7 valve position indicator	-	1-194	Q530	Refuel control panel	28-00-00 R/I	28-24-06
(88) Tank 2 valve position indicator	-	1-194	Q537	Refuel control panel	28-00-00 R/I	28-24-03
(89) Tank 3 valve position indicator	-	1-194	Q536	Refuel control panel	28-00-00 R/I	28-24-04

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(90) Tank 5A valve position indicator	-	1-194	Q539	Refuel control panel	28-00-00 R/I	28-24-05
(91) Tank 7A valve position indicator	-	1-194	Q538	Refuel control panel	28-00-00 R/I	28-24-06
(92) Tank 11 valve position indicator	-	1-194	Q527	Refuel control panel	28-00-00 R/I	28-24-07
(93) Tank 11 valve position relay	-	18-123	Q582	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-07
(94) Tank 9-10 selector switch	-	1-194	Q551	Refuel control panel	28-00-00 R/I	28-24-07
(95) Tank 5-6 selector switch	-	1-194	Q553	Refuel control panel	28-00-00 R/I	28-24-05
(96) Tank 7-8 selector switch	-	1-194	Q552	Refuel control panel	28-00-00 R/I	28-24-06
(97) Tank 11 selector switch	-	1-194	Q550	Refuel control panel	28-00-00 R/I	28-24-07
(98) Tank 9 LH trim valve	191 MB	-	Q403	In tank 10	28-23-21 R/I	28-23-06
(99) Tank 9 RH trim valve	192 MB	-	Q404	In tank 10	28-23-21 R/I	28-23-06
(100) Tank 5 trim valve	193 FB	-	Q405	In tank 5	28-23-21 R/I	28-23-08
(101) Tank 7 trim valve	196 BB	-	Q406	In tank 7	28-23-21 R/I	28-23-08

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(102) Tank 11 RH trim valve	752	-	Q408	In tank 11	28-23-21 R/I	28-23-07
(103) Tank 11 LH trim/ refuel valve interlock relay	-	18-123	Q660	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-01
(104) Tanks 9-10 load limit control selector	-	1-194	Q1058	Refuel control panel	28-24-51 R/I	28-24-01
(105) Tanks 5-6 load limit control selector	-	1-194	Q1059	Refuel control panel	28-24-51 R/I	28-24-01
(106) Tanks 7-8 load limit control selector	-	1-194	Q1060	Refuel control panel	28-24-51 R/I	28-24-01
(107) Tank 11 load limit control selector	-	1-194	Q1061	Refuel control panel	28-24-51 R/I	28-24-01
(108) Tank 10 standby inlet valve control switch	-	2-214	Q567	Fuel management panel (3CM)	28-00-00 R/I	28-24-08
(109) Tank 1 standby inlet valve control switch	-	2-214	Q573	Fuel management panel (3CM)	28-00-00 R/I	28-24-03
(110) Tank 4 standby inlet valve control switch	-	2-214	Q572	Fuel management panel (3CM)	28-00-00 R/I	28-24-04

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(111) Tank 5 standby inlet valve control switch	-	2-214	Q569	Fuel management panel (3CM)	28-00-00 R/I	28-24-05
(112) Tank 8 standby inlet valve control switch	-	2-214	Q570	Fuel management panel (3CM)	28-00-00 R/I	28-24-06
(113) Tank 6 standby inlet valve control switch	-	2-214	Q571	Fuel management panel (3CM)	28-00-00 R/I	28-24-05
(114) Tank 7 standby inlet valve control switch	-	2-214	Q568	Fuel management panel (3CM)	28-00-00 R/I	28-24-06
(115) Tank 2 standby inlet valve control switch	-	2-214	Q575	Fuel management panel (3CM)	28-00-00 R/I	28-24-03
(116) Tank 3 standby inlet valve control switch	-	2-214	Q574	Fuel management panel (3CM)	28-00-00 R/I	28-24-04
(117) Tank 10 standby inlet valve indi-cator	-	2-214	Q658	Fuel management panel (3CM)	28-00-00 R/I	28-24-08
(118) Tank 1 standby inlet valve indi-cator	-	2-214	Q654	Fuel management panel (3CM)	28-00-00 R/I	28-24-03
(119) Tank 4 standby inlet valve indi-cator	-	2-214	Q655	Fuel management panel (3CM)	28-00-00 R/I	28-24-04

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(120) Tank 2 standby inlet valve indi-cator	-	2-214	Q656	Fuel management panel (3CM)	28-00-00 R/I	28-24-03
(121) Tank 3 standby inlet valve indi-cator	-	2-214	Q657	Fuel management panel (3CM)	28-00-00 R/I	28-24-04
(122) Tank 11 inlet valve override control switch	-	5-214	Q379	Fuel management panel (3CM)	28-00-00 R/I	28-24-01
(123) LH refuel protection pressure switch	193 FB	-	Q632	Below tank 5	28-24-23 R/I	28-24-02
(124) RH refuel protection pressure switch	194 FB	-	Q631	Below tank 8	28-24-23 R/I	28-24-02
(125) LH over-pressure control relay	-	15-123	Q583	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(126) RH over-pressure control relay	-	18-123	Q580	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(127) LH re-fuel shut-off time delay relay	-	15-123	Q603	LH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(128) RH re-fuel shut-off time delay relay	-	18-123	Q602	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(129) LH re-fuel control unit (RCU)	193 LB	-	Q634	Below tank 5	28-24-21 R/I	28-24-02
(130) RH re-fuel control unit (RCU)	194 LB	-	Q633	Below tank 8	28-24-21 R/I	28-24-02
(131) Trim interlock relay	-	18-123	Q579	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-02
(132) Tank 11 trim/refuel C/O relay	-	18-123	Q584	RH fuel relay box, fwd. underfloor racking	28-00-00 R/I	28-24-07
(133) Tank 9 contents indicator	-	1-194	Q1026	Refuel control panel	28-44-83 R/I	28-44-04
(134) Tank 10 contents indicator	-	1-194	Q1028	Refuel control panel	28-44-83 R/I	28-44-04
(135) Tank 5 contents indicator	-	1-194	Q1034	Refuel control panel	28-44-83 R/I	28-44-02
(136) Tank 6 contents indicator	-	1-194	Q1036	Refuel control panel	28-44-83 R/I	28-44-02
(137) Tank 8 contents indicator	-	1-194	Q1044	Refuel control panel	28-44-83 R/I	28-44-03

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(138) Tank 7 contents indicator	-	1-194	Q1046	Refuel control panel	28-44-83 R/I	28-44-03
(139) Tank 11 contents indicator	-	1-194	Q1030	Refuel control panel	28-44-83 R/I	28-44-05

Component Identification
Table 101

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REFUEL - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

This topic contains instructions for the removal and installation of the refuel panel access door change-over relay, which is mounted in the ground power panel, 10-123, in the forward underfloor racking.

The relay is of the plug-in type and is secured in its mounting socket with nuts and washers.

General instructions for removal and installation of other minor electrical components, comprising refuel control switches, relays, captions, magnetic indicators and diodes, located on the upper fuel panel, refuel panel and in the fuel relay boxes, are contained in 28-00-00.

2. Refuel Panel Access Door Change-over Relay (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GRND POWER LTS SUP	25-216	X360	B5
FWD BAGGAGE DOOR FLOOD LT SUP	25-216	L762	C3
GRND POWER REFUEL CONT & IND	25-216	Q635	B8
FWD BAGGAGE DOOR LTS SUP	25-216	L763	C2
LH LDG/TAXI LT CONT	14-215	L41	E11

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LH LDG/TAXI LT SUP	14-215	L45	E10
RH LDG/TAXI LT CONT	13-216	L42	B9
RH LDG/TAXI LT SUP	13-216	L46	B8

(2) Open service compartment door 123 AB (Ref. 52-41-11) to gain access to the relay in the ground power panel, 10-123, mounted in the forward underfloor racking.

C. Remove

(1) Release the hold-down fasteners from the hooks on the ground power panel.

(2) Withdraw the panel from the rack sufficiently to gain access to the quick-release cable clamps on top of the panel.

(3) Release the cable clamps to detach the cables from the top of the panel.

(4) Withdraw the panel clear of the rack and lower it on to a suitable support.

(5) Remove the screws securing the top cover to the panel and remove the cover.

(6) Remove the nuts and washers securing the relay to the mounting base and withdraw the relay from the socket.

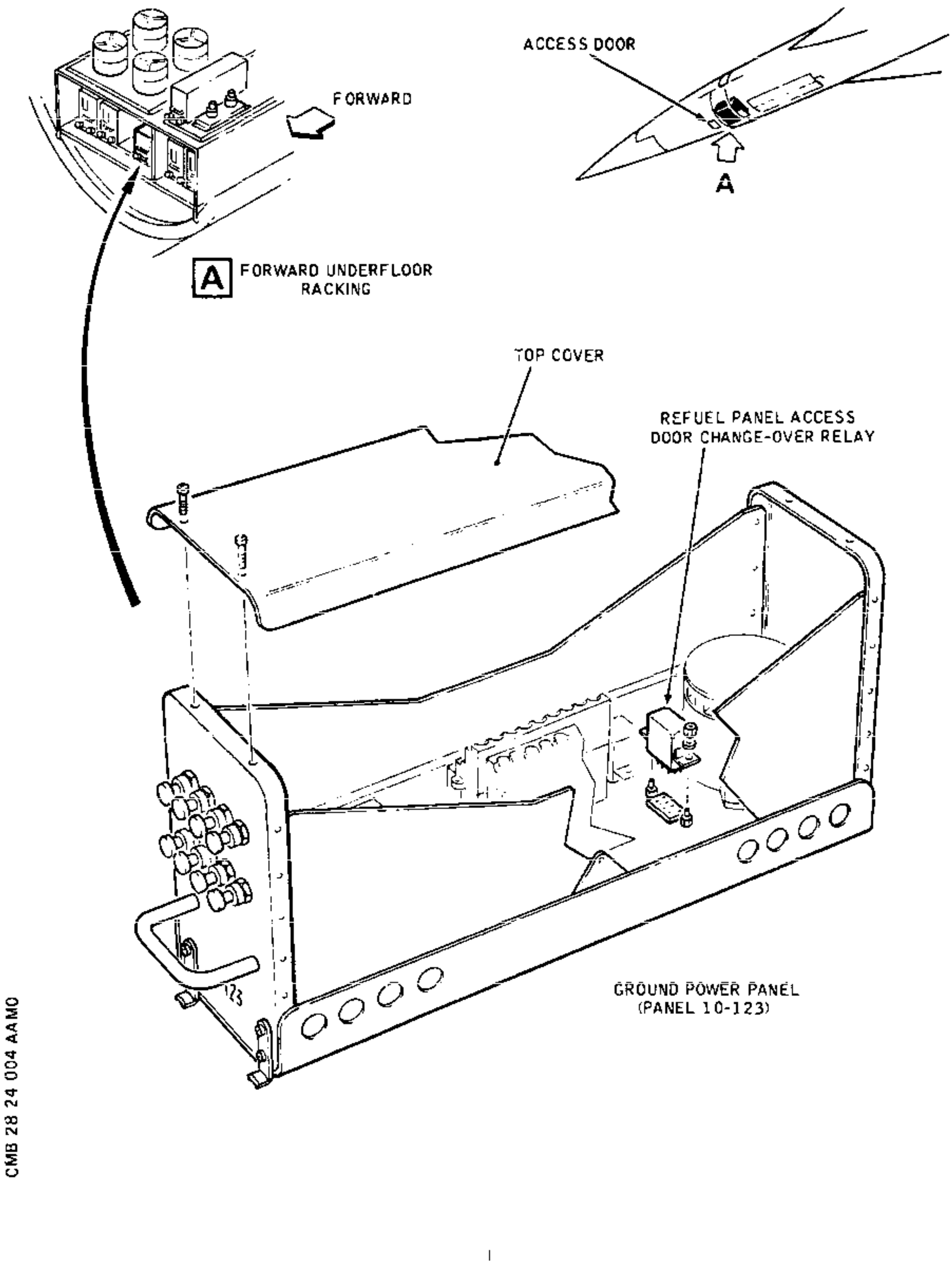
D. Install

(1) Comply with the electrical safety precautions.

(2) Align the locating pin on the relay body with the locating hole in the mounting base and plug the relay into the socket.

(3) Secure the relay to the base with the nuts and washers.

(4) Fit the top cover to the panel and secure it with the screws.



- Refuel Panel Access Door Change-over Relay - Installation
Figure 401

(5) Mount the panel on the end of the rack support rails and secure the cables to the top of the panel with the quick-release cable clamps.

(6) Insert the panel into the racking and secure it with the hold-down fasteners.

(7) Check that the panel is bonded in accordance with 20-27-11.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Check the operation of the relay by carrying out the appropriate test procedures.

R WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN
R 28-00-00, SERVICING.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED
R IN 24-00-00.

R OBSERVE THE SERVICING SAFETY PRECAUTIONS DETAILED
R IN 12-00-10 AND 12-11-28.

R 1. General

R This topic comprises a Functional Test divided, for convenience
R of application, into separate self-contained tests to which the
R trouble shooting procedures are allied.

R Operational Test requirements are fulfilled by the preparatory
R checks before refuelling, detailed in 12-11-28, therefore an
R Operational Test is not included here.

R A System Test is not applicable.

R During the following tests each tank must contain some fuel,
R to ensure that the associated valves do not operate in a dry
R state, and the aircraft balance must be safe (Ref. 12-00-10).

R The tests in total comprise a comprehensive check of the
R refuelling system components; headings and details are as
R follows.

R Refuel Control(s) (Ref. para.2.)

R This test checks the operation of the following:-

R Fuel management panel ground/flight indicator.

R Refuel panel captions.

R Refuel control units (RCUs) in the event of power failure.

R Fuel quantity indication power supplies.

R Refuel valves.

R RCU shut-off with trim valve open.

R Although this test includes operating the refuel valves by
R their associated standby inlet valve switches, a separate
R test is detailed in 28-23-00, Adjustment/Test.

R Load Limit Control (Ref. para.3.)

R This test checks the operation and control of the refuel
R valves via their load limit selectors.

R Overbalance Protection (Ref. para.4.)

R This test checks the nose landing gear operated micro-
R switches and the associated protection circuits for dormant
R faults.

R Overpressure Protection (Ref. para.5.)

R This test checks that the pressure switches operate within
R their nominal pressure range to shut-down the RCU.

R Refuelling Rate, High Level Shut-off and Overfull Shut-off
R (Ref. para.6.).

R This test checks -

R (1) the refuelling rate of each tank to high level shut-off,

R (2) the overfull shut-off operation (i.e., that the RCU
R shuts down at each tank overfull level) and

R (3) the static ground conditions overfull inhibit (i.e.,
R that the overfull signal is cancelled when the refuel
R valves are closed).

R 2. Refuelling Control(s) - Functional Test (Ref. Fig. 501)

R A. Prepare

R (1) Make available electrical ground power as detailed
R in 24-41-00.

R (2) Ensure that fuel management panel switches are at
R their normal ground settings (Ref. 28-00-00,
R Servicing).

R (3) Check, by reference to the aircraft attitude
R indicator (Ref. 12-11-10, Refuelling - Associated
R Operations), that the bubble is within the nominal
R ground attitude envelope.

R (4) If necessary, refuel (Ref. 12-11-28), transfer fuel
R (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00,
R Servicing) to ensure that the initial fuel state is
R as follows:-

R Tanks 9, 10, 1, 4, 5 and 8: 50 per cent full

R Tanks 6, 7, 2, 3, 5A, 7A and 11: Not more than
R 10 per cent full.

R (5) Display warning placards at the fuel management panel
R (3CM station) and refuel control panel to indicate
R that tests are being carried out on the fuel system.

R B. Test

R (1) With the refuel master switch at OFF-DEFUEL and the
R refuel control panel door shut, at the fuel manage-
R ment panel check that the RE-FUEL indicator displays
R FLT.

R (2) Open the refuel control panel door. Check that the
R RE-FUEL indicator displays GRD.

R (3) Set the refuel master switch to "SET UP" and close the
R refuel control panel door. Check that the RE-FUEL
R indicator displays GRD. At this stage, note the
R quantity displayed at all fuel tank quantity
R indicators (FQIs) on the fuel management panel.

R (4) Open the refuel control panel door and set the refuel
R master switch to "OFF-DEFUEL". Check that the refuel
R control panel FQIs are integrally illuminated
R and that the failure warning flag in the TOTAL
R CONTENTS indicator is withdrawn.

R (5) Check that the TV OPEN, OVER PRESS, O/BALANCE, TANK
R O/F and NOT OPEN captions are not illuminated.

R (6) Press and release the FILAMENT TEST switch. Check
R that the TV OPEN, OVER PRESS, O/BALANCE, TANK O/F,
R NOT OPEN and PRV captions are illuminated and then
R extinguished.

R (7) Set the LH and RH RCUs to open. Check that the RCU
R indicator displays OPEN.

R (8) Set the refuel master switch to "SET UP". Check
R that -

R (a) the PRV caption is illuminated,

R (b) the FQI failure flags are withdrawn,

R (c) the FQI readings agree with the fuel management
R panel FQI readings previously noted and,

(d) after a delay of 5 s, both RCU indicators display FAILED.

(9) Reset both RCUs to shut. Check that the RCU indicators display SHUT.

(10) Operate the FQI TEST switch. Check that -

(a) tanks 1, 2, 3, 4, 5A and 7A indicators each show an increase of approimately 200 kg,

(b) tanks 5, 6, 7, 8, 9 and 10 indicators each show an increase of approximately 500 kg,

(c) tank 11 indicator shows an increase of approx- imately 3,000 kg, and

(d) the TOTAL CONTENTS indicator shows an increase of approximately 7,200 kg.

(11) Gain access to all (13) refuel valves (Ref. Table 501).

REFUEL VALVE	ACCESS PANEL	EQUIP. IDENT.	CHAP. REF.
Tank 9	191 MB	Q618	28-24-12
Tank 10	192 MB	Q619	28-24-12
Tank 1	193 DB	Q625	28-24-12
Tank 4	194 DB	Q624	28-24-12
Tank 5	193 GB	Q621	28-24-12
Tank 8	194 MB	Q622	28-24-12
Tank 6	195 DB	Q623	28-24-12
Tank 7	196 DB	Q620	28-24-11
Tank 2	197 EB	Q627	28-24-11
Tank 3	198 EB	Q626	28-24-11
Tank 5A	532 AT	Q629	28-24-11

REFUEL VALVE	ACCESS PANEL	EQUIP. IDENT.	CHAP. REF.
Tank 7A	632 AT	Q628	28-24-11
Tank 11	752	Q407	28-23-21

Refuel Valve Location (Total)
Table 501

(12) Individually set each refuel valve switch to "OPEN". Check that -

(a) the associated valve position indicator display changes from black to yellow,

NOTE: The refuel valve position indicators are energized (display black) only when the refuel valve is closed.

(b) the standby inlet valve position indicator display (panel 2-214), for tanks 10, 1, 4, 2 and 3, changes from SHUT to diagonal stripes and then to OPEN,

(c) tank 11 LH trim inlet valve position indicator display (panel 5-214) changes from bar-across-line to diagonal stripes and then to bar-in-line,

(d) with the exception of tank 11, the OPEN 'pop-out' mechanical visual indicator on the valve is extended,

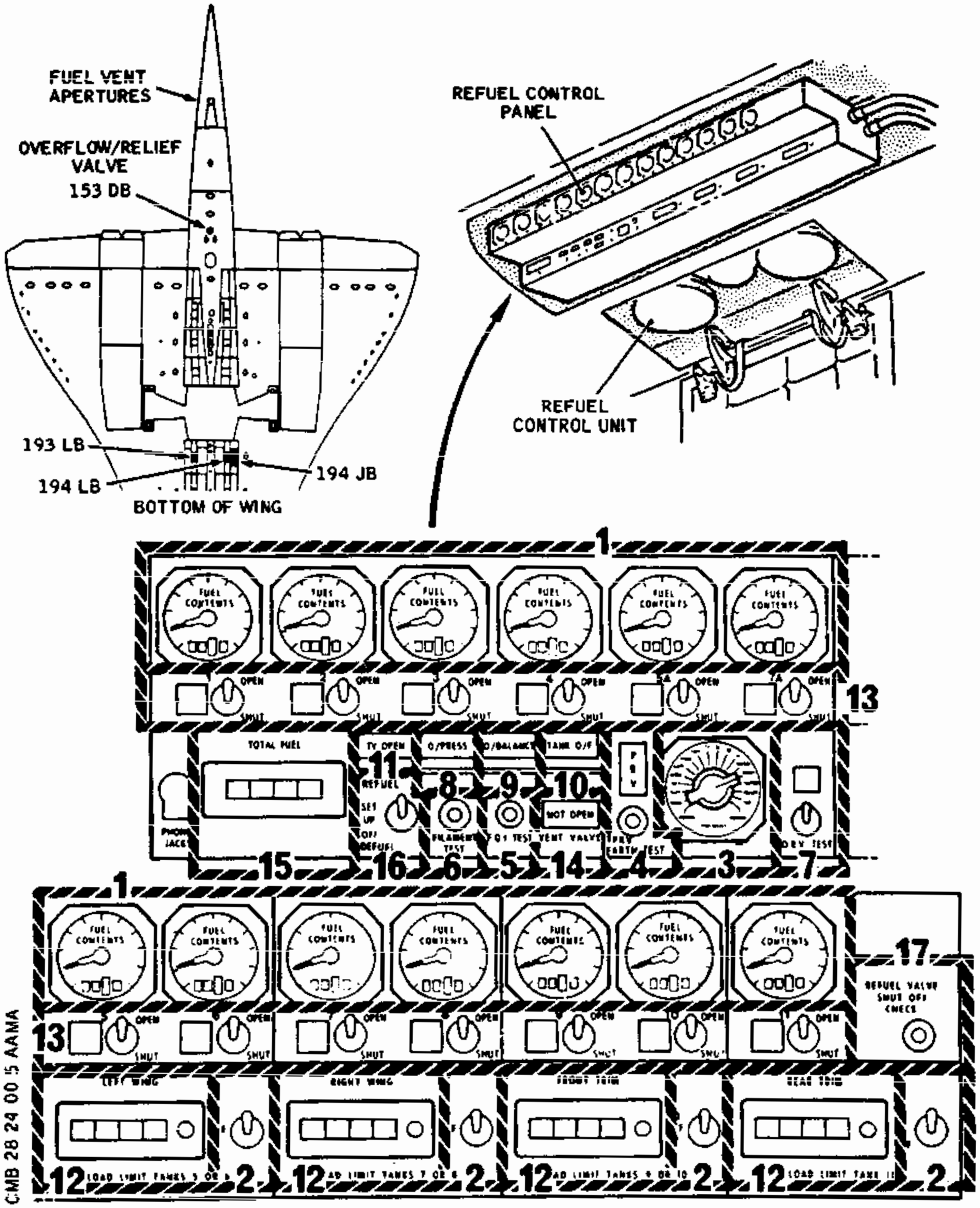
(e) for tank 11 LH trim/refuel valve, the mechanical visual indicator (arm) is at OPEN, and

(f) the valve is fully open within 2 s of switch operation.

(13) Press and hold the REFUEL VALVE SHUT-OFF CHECK switch. Check that -

(a) all (13) refuel valve position indicator displays change from yellow to black,

(b) the standby inlet valve position indicator display (panel 2-214), for tanks 10, 1, 4, 2 and 3, changes from OPEN to diagonal stripes



Refuelling Controls and Indicators
(Sheet 1 of 2)
Figure 501

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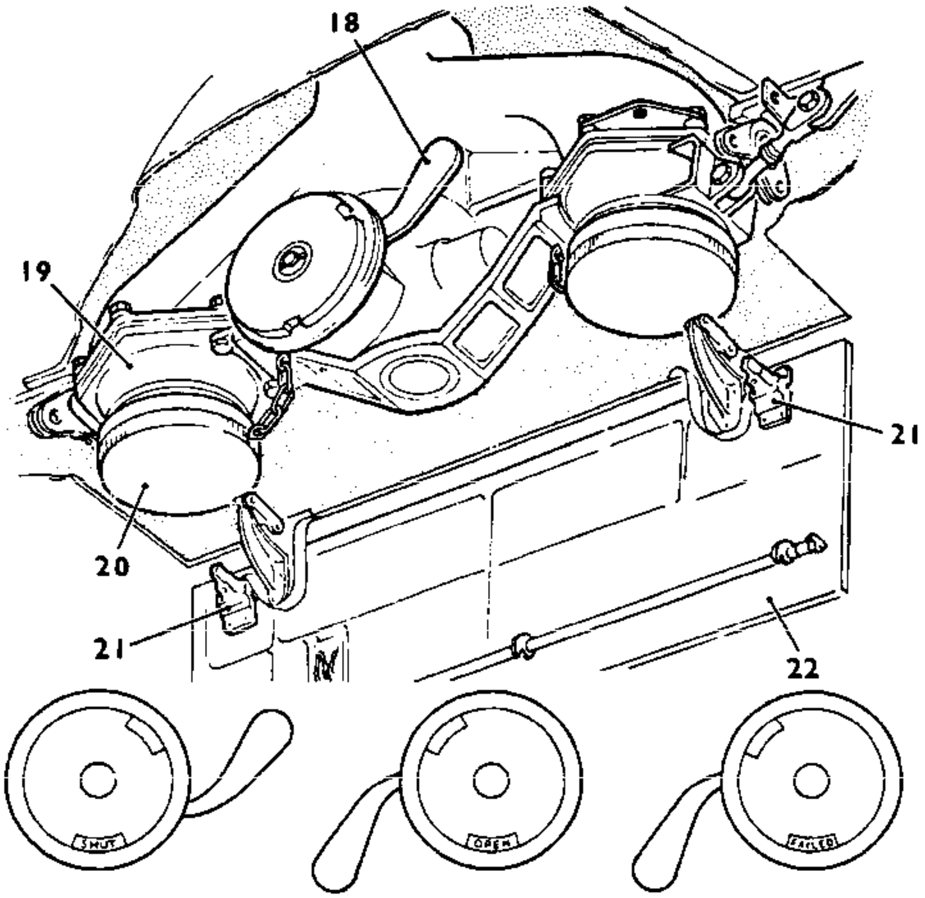

R.C.U. CLOSED R.C.U. OPEN R.C.U. FAILED

1 FUEL QUANTITY INDICATOR
2 TANKS SELECTOR SWITCH
3 TPRV SELECTOR SWITCH
4 TPRV TEST SWITCH AND CAPTION LIGHT
5 FQI TEST SWITCH
6 FILAMENT TEST SWITCH
7 ORV TEST SWITCH AND INDICATOR
8 OVERPRESSURE CAPTION LIGHT
9 OVERBALANCE CAPTION LIGHT
10 TANK OVERFULL CAPTION LIGHT
11 TRIM VALVE OPEN CAPTION LIGHT
12 LOAD LIMIT SELECTOR
13 TANK INLET VALVE CONTROL SWITCH AND INDICATOR
14 VENT SHUT-OFF VALVE CAPTION LIGHT
15 TOTAL FUEL QUANTITY INDICATOR
16 REFUEL MASTER SWITCH
17 REFUEL VALVE SHUT-OFF CHECK SWITCH
18 CONTROL HANDLE
19 REFUELLING COUPLING
20 BLANKING CAP
21 BONDING POINT
22 ACCESS DOOR

AFTER SB 53-042A-
THE RCU DOOR-OPEN LATCH LINK-OVER CENTRE LOCKING SYSTEM IS REPLACED BY A SPRING CLIP LATCH.

CMB 28 24 00 5 AAMB

\- Refuelling Controls and Indicators
(Sheet 2 of 2)
Figure 501

R and then to SHUT,

R (c) tank 11 LH trim inlet valve position indicator
R display (panel 5-214) changes from bar-in-line
R to diagonal stripes and then to bar-across-line,

R (d) with the exception of tank 11, the SHUT 'pop-
R out' mechanical visual indicator is extended,

R (e) for tank 11 LH trim/refuel valve, the mechanical
R visual indicator (arm) is at SHUT, and

R (f) all valves are fully shut within 2 s of switch
R operation.

R (14) Release the refuel valve shut-off check switch.
R Check that all (13) refuel valves re-open.

R (15) Set all (13) refuel valve switches to "SHUT". Check
R that all valves are shut within 2 s of switch
R operation.

R (16) Set the refuel master switch to "OFF-DEFUEL" and close
R the refuel control panel door.

R (17) At the fuel management panel, individually set each
R (9) STANDBY INLET VALVE control switch to "OPEN".
R Check that -

R (a) tanks 10, 1, 4, 2 and 3 standby inlet valve
R position indicator displays change from SHUT to
R diagonal stripes and then to OPEN,

R (b) for tanks 5, 8, 6 and 7 the OPEN 'pop-out'
R mechanical visual indicator on the valve is
R extended, and

R (c) the valve is fully open within 2 s of switch
R operation.

R (18) Set all (9) STANDBY INLET VALVE switches to "SHUT".
R Check that all valves are shut within 2 s of switch
R operation.

R (19) Set tank 11 LH INLET VALVE OVERRIDE switch to "OPEN".
R Check that the valve position indicator display
R changes from bar-across-line to diagonal stripes and
R then to bar-in-line and that the mechanical visual
R indicator on the valve is at OPEN.

R (20) Open the refuel control panel door. Check that the

R TV OPEN caption is illuminated.

R (21) Reset tank 11 LH INLET VALVE OVERRIDE switch to "SHUT". Wait until the valve position indicator displays bar-across-line and then set the OVERRIDE switch to "OFF". Check that the TV OPEN caption is extinguished.

R (22) At the fuel management panel, individually set the following trim inlet valve MAIN switches to "OPEN": tanks 9 LH, 9 RH, 5, 7 and 11 RH. Wait until the associated indicator displays bar-in-line and then set the switch to "AUTO". Check, at the refuel control panel, that -

R (a) as the valve starts to open, the TV OPEN caption is illuminated and,

R (b) when the valve is shut, the TV OPEN caption is extinguished.

R (23) Set the LH and RH RCUs to "OPEN". Set tank 9 LH trim inlet valve MAIN switch to "OPEN". Check that -

R (a) both RCU indicator displays change to FAILED, and

R (b) the TV OPEN caption is illuminated.

R (24) Set both RCUs to "SHUT".

R C. Conclusion

R (1) Ensure that the fuel management panel and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (2) Remove the warning placards and close the refuel control panel door.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R (4) Refit the panels previously removed.

R 3. Load Limit Control - Functional Test

R A. Prepare

R (1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Check, by reference to the aircraft attitude indicator (Ref. 12-11-10, Refuelling - Associated Operations), that the bubble is within the nominal ground attitude envelope.

(4) If necessary, refuel (Ref. 12-11-28), transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing), to ensure that the initial fuel state is as follows:-

Tank 9, 10, 5 and 8: 50 per cent full

Tanks 1 and 4: Full

Tanks 6, 7, 2, 3, 5A, 7A and 11: Not more than 10 per cent full

(5) Display warning placards at the fuel management panel and refuel control panel to indicate that tests are being carried out on the fuel system.

<u>NOTE</u>: As the refuel valve position indicators are energized (display black) only when the refuel valves are closed, the 'valve open' position must be verified at the mechanical visual indicator on the valve.

(6) Gain access to the refuel valves (Ref. Table 502).

REFUEL VALVE	ACCESS PANEL	EQUIP. IDENT.	CHAP. REF.
Tank 9	191 MB	Q618	28-24-12
Tank 10	192 MB	Q619	28-24-12
Tank 5	193 GB	Q621	28-24-12
Tank 6	195 DB	Q623	28-24-12
Tank 8	194 MB	Q622	28-24-12

REFUEL VALVE	ACCESS PANEL	EQUIP. IDENT.	CHAP. REF.
Tank 7	196 DB	Q620	28-24-11
Tank 11	752	Q407	28-23-21

Refuel Valve Location (Load Limit Control Test)
Table 502

B. Test

(1) At the refuel control panel set the refuel master switch to "REFUEL".

(2) Set tanks 9 and 10 refuel switches to "OPEN". Check that -

(a) the valve position indicator display changes from black to yellow, and

(b) the OPEN 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

(3) Set tanks 9-10 load limit control (LLC) selector to at least 150 kg above tank 9 contents.

(4) Set tanks 9-10 selector switch to "9". Check that tanks 9 and 10 refuel valves remain open.

(5) Slowly reduce tanks 9-10 LLC selector setting to at least 150 kg below tank 9 contents. Check that tank 9 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 9 contents.

(6) Slowly increase tanks 9-10 LLC selector setting to at least 150 kg above tank 9 contents. Check that tank 9 refuel valve opens when the LLC selector setting is within ±100 kg of tank 9 contents.

(7) Set tanks 9-10 LLC selector to at least 150 kg above tank 10 contents.

(8) Set tank 9-10 selector switch to "10". Check that tanks 9 and 10 refuel valves remain open.

(9) Slowly reduce tanks 9-10 LLC selector setting to at

least 150 kg below tank 10 contents. Check that tank 10 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 10 contents.

(10) Slowly increase tanks 9-10 LLC selector setting to at least 150 kg above tank 10 contents. Check that tank 10 refuel valve opens when the LLC selector setting is within ±100 kg of tank 10 contents.

(11) Set tanks 9-10 selector switch to "OFF".

(12) Set tanks 9-10 LLC selector to "00000".

(13) Set tanks 9 and 10 refuel valve switches to "SHUT". Check that -

(a) the valve position indicator display changes from yellow to black, and

(b) the SHUT 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

(14) Set tanks 5 and 6 refuel valve switches to "OPEN". Check that -

(a) the valve position indicator display changes from black to yellow, and

(b) the OPEN 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

(15) Set tanks 5-6 load limit control (LLC) selector to at least 150 kg above tank 5 contents.

(16) Set tanks 5-6 selector switch to "5". Check that tanks 5 and 6 refuel valves remain open.

(17) Slowly reduce tanks 5-6 LLC selector setting to at least 150 kg below tank 5 contents. Check that tank 5 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 5 contents.

(18) Slowly increase tanks 5-6 LLC selector setting to at least 150 kg above tank 5 contents. Check that tank 5 refuel valve opens when the LLC selector setting is within ±100 kg of tank 5 contents.

(19) Set tanks 5-6 LLC selector to at least 150 kg above tank 6 contents.

(20) Set tank 5-6 selector switch to "6". Check that tanks 5 and 6 refuel valves remain open.

(21) Slowly reduce tanks 5-6 LLC selector setting to at least 150 kg below tank 6 contents. Check that tank 6 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 6 contents.

(22) Slowly increase tanks 5-6 LLC selector setting to at least 150 kg above tank 6 contents. Check that tank 6 refuel valve opens when the LLC selector setting is within ±100 kg of tank 6 contents.

(23) Set tanks 5-6 selector switch to "OFF".

(24) Set tanks 5-6 LLC selector to "00000".

(25) Set tanks 5 and 6 refuel valve switches to "SHUT". Check that -

(a) the valve position indicator display changes from yellow to black, and

(b) the SHUT 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

(26) Set tanks 7 and 8 refuel switches to "OPEN". Check that -

(a) the valve position indicator display changes from black to yellow, and

(b) the OPEN 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

(27) Set tanks 8-7 load limit control (LLC) selector to at least 150 kg above tank 8 contents.

(28) Set tanks 8-7 selector switch to "8". Check that tanks 8 and 7 refuel valves remain open.

(29) Slowly reduce tanks 8-7 LLC selector setting to at least 150 kg below tank 8 contents. Check that tank 8 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 8 contents.

(30) Slowly increase tanks 8-7 LLC selector setting to at least 150 kg above tank 8 contents. Check that tank 8 refuel valve opens when the LLC selector

R setting is within ±100 kg of tank 8 contents.

R (31) Set tanks 8-7 LLC selector to at least 150 kg above tank 7 contents.

R (32) Set tank 8-7 selector switch to "7". Check that tanks 8 and 7 refuel valves remain open.

R (33) Slowly reduce tanks 8-7 LLC selector setting to at least 150 kg below tank 7 contents. Check that tank 7 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 7 contents.

R (34) Slowly increase tanks 8-7 LLC selector setting to at least 150 kg above tank 7 contents. Check that tank 7 refuel valve opens when the LLC selector setting is within ±100 kg of tank 7 contents.

R (35) Set tanks 8-7 selector switch to "OFF".

R (36) Set tanks 8-7 LLC selector to "00000".

R (37) Set tanks 8 and 7 refuel valve switches to "SHUT". Check that -

R (a) the valve position indicator display changes from yellow to black, and

R (b) the SHUT 'pop-out' mechanical visual indicator on each valve is extended within 2 s of switch operation.

R (38) Set tank 11 refuel valve switch to "OPEN". Check that -

R (a) the valve position indicator display changes from black to yellow, and

R (b) the mechanical visual indicator (arm), on the valve, is at OPEN within 2 s of switch operation.

R (39) Set the tank 11 LLC selector to at least 150 kg above tank 11 contents.

R (40) Set tank 11 selector switch to "11". Check that tank 11 refuel valve remains open.

R (41) Slowly reduce tank 11 LLC selector setting to at least 150 kg below tank 11 contents. Check that tank 11 refuel valve shuts when the LLC selector setting is within ±100 kg of tank 11 contents.

R (42) Slowly increase tank 11 LLC selector setting to at least 150 kg above tank 11 contents. Check that tank 11 refuel valve opens when the LLC selector setting is within ±100 kg of tank 11 contents.

R (43) Set tank 11 selector switch to "OFF".

R (44) Set tank 11 LLC selector to "00000".

R (45) Set tank 11 refuel switch to "SHUT". Check that -

R (a) the valve position indicator display changes from yellow to black, and

R (b) the mechanical visual indicator (arm), on the valve, is at SHUT within 2 s of switch operation.

R C. Conclusion

R (1) Ensure that the fuel management panel and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (2) Remove the warning placards and close the refuel control panel door.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R (4) Refit the panels previously removed.

R 4. <u>Overbalance Protection - Functional Test</u>

R A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Nose jack (Ref. 7-11-00)	-
Safety stay (Ref. 7-11-00)	-
Nose jacking pad	D925370000

R B. Prepare

R (1) Make available electrical ground power as detailed in 24-41-00.

R (2) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R (3) Check, by reference to the aircraft attitude indicator (Ref. 12-11-10, Refuelling - Associated Operations), that the bubble is within the nominal ground attitude envelope.

R (4) If necessary, refuel (Ref. 12-11-28), transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing), to ensure that the initial fuel state is as follows:-

R Tanks 9, 10, 5 and 8: 50 per cent full

R Tanks 1 and 4: Full

R Tanks 6, 7, 2, 3, 5A, 7A and 11: Not more than 10 per cent full.

R (5) Display warning placards at the fuel management panel and refuel control panel to indicate that tests are being carried out on the fuel system and that the aircraft will be jacked-up at the nose jacking point.

R (6) Ensure that the nose shock absorber strut is correctly charged (Ref. 32-21-24, Servicing).

R (7) Ensure that the weight on the nose wheel is not less than 4,000 kg, i.e., dimension 'D' is not greater than 19.5 in (495 mm) (Ref. Weight and Balance Manual, 1-80-00, Aircraft Balance During Ground Operations).

R (8) Ensure that no one is in the aircraft.

R (9) Observe the jacking precautions in 7-11-00 and attach the nose jack to frame 28 and position a safety stay at frame 72.

R (10) Gain access to all refuel valves (Ref. Table 501).

R C. Test

R (1) Open the refuel control panel door and set the refuel master switch to "REFUEL".

R (2) Set the LH and RH RCUs to "OPEN". Check that the RCU

indicators display OPEN.

(3) Set all (13) refuel valve switches to "OPEN". Check that -

(a) the associated valve position indicator display changes from black to yellow,

NOTE: The refuelling valve position indicators are energized (display black) only when the refuel valves are closed.

(b) with the exception of tank 11, the OPEN 'pop-out' mechanical visual indicator on the valves are fully extended,

(c) for tank 11 LH trim/refuel valve, the mechanical visual indicator (arm) is at OPEN, and

(d) the valves are fully open within 2 s of switch operation.

(4) Monitor the clearance at frame 72 safety stay and, using the jack, slowly lift the aircraft nose until the shock absorber strut is at full extension, i.e., dimension 'D' is between 24.4 and 24.8 in (620 to 630 mm) (Ref. Weight and Balance Manual, 1-80-00, Aircraft Balance During Ground Operations). As the shock absorber extends between 22.82 and 24.2 in (580 to 615 mm), check that -

(a) the O/BALANCE caption is briefly illuminated and then extinguished,

(b) the refuel valves for tanks 5A, 7A and 11 close immediately and ,

(c) after a delay of 3 s, tanks 6, 7, 2 and 3 refuel valves close.

(5) Simulate tank 11 trim/refuel valve not closed, by tripping the TANK 11 LH INLET VALVE MAIN SUP circuit breaker Q365, on panel 15-215, map ref.G21. Check that -

(a) the O/BALANCE caption is illuminated and,

(b) after a delay of 5 s, both RCU indicators display FAILED.

(6) Reset the TANK 11 LH INLET VALVE MAIN SUP circuit

breaker Q365, on panel 15-215, map ref.G21. Check that the O/BALANCE caption is extinguished.

(7) Reset the LH and RH RCUs to "SHUT" and then to "OPEN". Ensure that each RCU indicator displays OPEN.

(8) Slowly lower the aircraft nose until the aircraft weight is fully on the nosewheels. As the shock absorber strut is compressed between 24.2 and 22.82 in (615 to 580 mm), check that tanks 6, 7, 2, 3, 5A, 7A and 11 refuel valves reopen.

D. Conclusion

(1) Set all (13) refuel valve switches to "SHUT". Ensure that all valves shut.

(2) Set the LH and RH RCUs to "SHUT".

(3) Set the refuel master switch to "OFF-DEFUEL".

(4) Remove the nose jack and jacking pad from frame 28 (Ref. 7-11-00).

(5) Remove the safety stay from frame 72 (Ref. 7-11-00).

(6) Ensure that the fuel management panel and refuel control panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(7) Remove the warning placards and close the refuel control panel door.

(8) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(9) Refit the panels previously removed.

5. Overpressure Protection - Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Hose end unit (Avery Hardoll)	PN HU 2204
Suitable adapter, for hose end unit	-
Refuel pressure test rig, capable of producing a pressure	-

DESCRIPTION	PART NO.
of 80 psig (5.520 bar)	

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Check, by reference to the aircraft attitude indicator (Ref. 12-11-10, Refuelling - Associated Operations), that the bubble is within the nominal ground attitude envelope.

(4) If necessary, refuel (Ref. 12-11-28), transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing), to ensure that the initial fuel state is as follows:-

Tank 9, 10, 5 and 8: 50 per cent full

Tanks 1 and 4: Full

Tanks 6, 7, 2, 3, 5A, 7A and 11: Not more than 10 per cent full.

(5) Display warning placards at the fuel management panel and refuel control panel to indicate that tests are being carried out on the fuel system.

(6) Using the hose end unit and suitable adapter, connect the refuel pressure test rig to the LH RCU.

(7) Ensure that the test rig and aircraft are individually earthed and bonded to each other (Ref. 12-11-28).

C. Test

NOTE: The refuel protection pressure switches (Ref. 28-24-23) must be tested individually. This test procedure is written primarily for the LH system; where applicable, the RH system references are in brackets.

(1) Open the refuel control panel door and set the refuel master switch to "REFUEL".

(2) Set the LH (RH) RCU to "OPEN". Check that the RCU indicator displays OPEN.

NOTE: The associated LH (RH) refuel shut-off time delay relay has a time delay of 5 s before it is de-energized. Therefore, when the test pressures are near the operating range of the pressure switch, the test pressures must be raised in 1 psig (0.069 bar) increments, with at least a 10 s delay between increments. Also, thermal relief valves in the refuel/trim piping will bleed fuel out of the piping, therefore test pressure increments must be maintained.

Before SB 28-035

(3) Using the test rig, slowly apply a pressure of 65 psig (4.485 bar). Raise the fuel pressure from 59 to 64 psig (4.068 to 4.413 bar) in 1 psig (0.069 bar) increments. During this pressure change check that -

(a) the OVER PRESS caption becomes illuminated and

(b) the RCU indicator display changes to FAILED.

(4) Slowly release the test pressure. As the test pressure drops between 59 and 54 psig (4.068 and 3.726 bar), check that the OVER PRESS caption remains illuminated.

(5) When the falling pressure is 54 psig (3.726 bar), set the RCU to "SHUT" and then to "OPEN". Check that -

(a) with the RCU at SHUT, the OVER PRESS caption is extinguished and,

(b) with the RCU at OPEN, the RCU indicator displays OPEN and the OVER PRESS caption remains extinguished.

After SB 28-035 For A/C 001-007,

(3) Using the test rig, slowly apply a pressure of 76 psig (5.244 bar). Raise the fuel pressure from 70 to 75 psig (4.830 to 5.175 bar) in 1 psig (0.069 bar)

R increments. During this pressure change check that -

R (a) the OVER PRESS caption becomes illuminated and

R (b) the RCU indicator display changes to FAILED.

R (4) Slowly release the test pressure. As the test pressure drops between 70 and 65 psig (4.830 and 4.485 bar), check that the OVER PRESS caption remains illuminated.

R (5) When the falling pressure is 65 psig (4.485 bar), set the RCU to "SHUT" and then to "OPEN". Check that -

R (a) with the RCU at SHUT, the OVER PRESS caption is extinguished and,

R (b) with the RCU at OPEN, the RCU indicator displays OPEN and the OVER PRESS caption remains extinguished.

R (6) Set the RCU handle to "SHUT" and transfer the test equipment to the RH RCU and repeat operations (2) to (5), inclusive.

R D. Conclusion

R (1) Disconnect the test rig from the RH RCU.

R (2) Remove the warning placards and close the RCU panels and refuel control panel door.

R (3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

R 6. <u>Refuelling Rate, High Level Shut-off and Overfull Shut-off - Functional Test</u>

R <u>NOTE</u>: For this test the aircraft should preferably be fully equipped, so that the zero fuel c.g., and hence the fuel loaded c.g., can be accurately determined (Ref. 12-00-10, Aircraft Ground Stability), otherwise tanks 2, 3, 6 and 7 must be defuelled before tank 11 is filled.

R A. Equipment and Materials

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DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Refuelling facility	-
Safety stay (Ref. 7-11-00)	-
Receptacle, for fuel, 50 gal (Imp.) (227 l)	-
Adapter, fuel overflow pipe	E925127030
Flexible hose, 3 in (76.2 mm) ID, 12 ft (3.66 m) long, for fuel overflow	-

B. Prepare

NOTE: When tanks 1 to 10 are filled to overfull a small amount of fuel may overflow via the vent system into the scavenge tank. If a RCU fails to close during the overfull shut-off test, a considerable quantity of fuel may be discharged via the vent system and ORV. Therefore, to contain any possible fuel overflow, a fuel receptacle is used during these tests.

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that the fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Display warning placards at the fuel management panel and refuel control panel, to indicate that tests are being carried out on the fuel system.

(4) If necessary, refuel (Ref. 12-11-28), transfer fuel (Ref. 28-00-00, Servicing) or defuel (Ref. 28-25-00, Servicing), to ensure that the initial fuel state is as follows:-

Tanks 9, 10, 1, 4, 5 and 8: 50 per cent full

Tanks 6, 7, 2, 3, 5A, 7A and 11: Not more than

R 10 per cent full.

R (5) Position a safety stay at frame 72 (Ref. 7-11-00).

R (6) Ensure that the scavenge pump is not running. Trip the SCAVENGE PUMP CONT & IND circuit breaker Q493, on panel 15-216, map ref.C6; fit a safety clip.

R (7) Set the ORV to open, as follows:-

R (a) At the refuel control panel, set and hold the ORV TEST switch to "TEST".

R (b) Wait until the ORV indicator display changes from SHUT to diagonal stripes and then to OPEN.

R (c) When the ORV is open, trip the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721, on panel 1-213, map ref.K15, and fit a safety clip.

R (d) Release the ORV TEST switch from the TEST position. Check that the ORV does not close.

R (8) Fit the fuel overflow pipe adapter to the ORV outlet, and connect the flexible hose to the adapter.

R (9) Position the fuel receptacle near the ORV outlet and put the free end of the flexible hose into the receptacle.

R (10) Electrically bond the fuel receptacle to the aircraft and ground.

R (11) Connect a refuelling facility to each refuel control unit (RCU) and prepare to refuel (Ref. 12-11-28).

R C. Test

R CAUTION: DURING THESE PROCEDURES, MONITOR THE ORV OUTLET AND CLEARANCE AT FRAME 72 SAFETY STAY. IF FUEL IS DISCHARGED AT A HIGH RATE FROM THE ORV OUTLET, STOP REFUELLING IMMEDIATELY.

R (1) Carry out the following procedure for each tank in turn, in the following order:-

R Tank 9, 10, 1, 4, 5, 8, 6, 7, 2, 3, 5A, 7A, 11

R (a) Refuel the tank to High Level Shut-off (HLSO), checking that -

a1) the refuelling rate is correct (Ref. Table 503) and

a2) HLSO occurs at the correct level (Ref. Table 504).

TANK NO.	REFUELLING RATE	
	l/min	gal/min (Imp.)
9	1,259 to 1,423	277 to 313
10	1,145 to 1,291	252 to 284
1 & 4	241 to 268	53 to 59
5	600 to 673	132 to 148
8	982 to 1109	216 to 244
6	1,196 to 1,350	263 to 297
7	564 to 636	124 to 140
2	309 to 354	68 to 78
3	241 to 268	53 to 59
5A	264 to 300	58 to 66
7A	186 to 205	41 to 45
**ON A/C ALL		
11	705 to 796	155 to 175

Refuelling Rates
Table 503

TANK NO.	CONTENTS INDICATED (kg) AT HLSO (sp. gr. 0.790)
9	10,850 to 11,290

R

TANK NO.	CONTENTS INDICATED (kg) AT HLSO (sp. gr. 0.790)
10	11,670 to 12,150
1 & 4	4,110 to 4,270
5	7,050 to 7,330
8	12,555 to 13,065
6	11,330 to 11,790
7	7,245 to 7,535
2 & 3	4,470 to 4,650
5A & 7A	2,180 to 2,320
11	10,180 to 10,600

Tank Contents at High Level Shut-off
Table 504

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 9 REFUEL VALVE SUP	15-216	Q515	F9
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22
TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
TANK 4 REFUEL VALVE SUP	15-215	Q521	E24
TANK 5 REFUEL VALVE SUP	15-215	Q518	E25
TANK 8 REFUEL VALVE SUP	15-215	Q519	F19
TANK 6 REFUEL VALVE SUP	15-215	Q520	F20
TANK 7 REFUEL VALVE SUP	15-215	Q517	F21
TANK 2 REFUEL VALVE SUP	15-216	Q524	F10

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
TANK 5A REFUEL VALVE SUP	15-216	Q526	F4
TANK 7A REFUEL VALVE SUP	15-216	Q525	F5
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q365	G21

Refuel Inlet Valve - Circuit Breakers
Table 505

(b) Defuel or transfer fuel from the tank until the refuel valve reopens.

(c) Keep the valve open by tripping its associated circuit breaker (Ref. Table 505). Fit a safety clip.

(d) Slowly refuel the tank until the refuel panel TANK O/F caption is illuminated. Check that both RCU indicators display FAILED.

(e) Reset the associated valve supply circuit breaker (Ref. Table 505). Check that the TANK O/F caption is extinguished.

NOTE: With the refuel control panel door open, an overfull inhibit relay Q600 (Ref. Wiring Diagram Manual, 28-24-01) is used to inhibit the fuel management panel (3CM) overfull captions for tanks 1, 2, 3 and 4 only. Tests associated with this relay are carried out in 28-42-00, Adjustment/Test - Functional Test.

(f) Reset each RCU to "SHUT" and then to "OPEN". Ensure that each RCU indicator displays OPEN.

(g) Defuel (Ref. 28-25-00, Servicing) or transfer fuel (Ref. 28-00-00, Servicing) until the refuel valve reopens.

(h) Set the tank refuel valve switch to "SHUT". Ensure that the associated valve position

R indicator displays black.

R D. Conclusion

R (1) Defuel the aircraft to maintenance/flight
R requirements.

R (2) Disconnect the refuelling facility (Ref. 12-11-28).

R (3) Remove the overflow pipe adapter and flexible hose
R from the ORV outlet; also remove the fuel receptacle.

R (4) Remove the safety clips and reset the circuit breakers
R for the scavenge pump control and indication, and
R those for the overflow relief valve supply and
R indication. Ensure that the ORV closes.

R <u>NOTE</u>: The scavenge pump will run for approximately
R 30 s when the circuit breaker is reset.

R (5) Remove the safety stay.

R (6) Remove the warning placards.

R (7) Switch off and disconnect electrical ground power
R as detailed in 24-41-00.

R REFUELLING - APPROVED REPAIRS

1. General

NOTE: When manufacturing new pipes, L.56 is an approved alternative for AG.3 material.

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REFUEL TANK INLET VALVE (1 in) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

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1. General

Five 1 in refuel tank inlet valves are fitted to control the refuelling of tanks 2, 3, 5A, 7 and 7A. Each valve unit consists of a motorized valve element mounted in a canister which allows the removal of the valve element without the necessity of defuelling the tank. To remove the canisters, it is necessary to defuel the tank in which the canister is installed and also the trim transfer pipe. The canisters for tanks 2, 3 and 7 are mounted in their respective tanks and the canisters for tanks 5A and 7A are mounted in tanks 6 and 7 respectively.

This topic contains the procedures for the removal and installation of a valve element, a valve motor and a canister (two differing canister procedures, according to location), under separate headings.

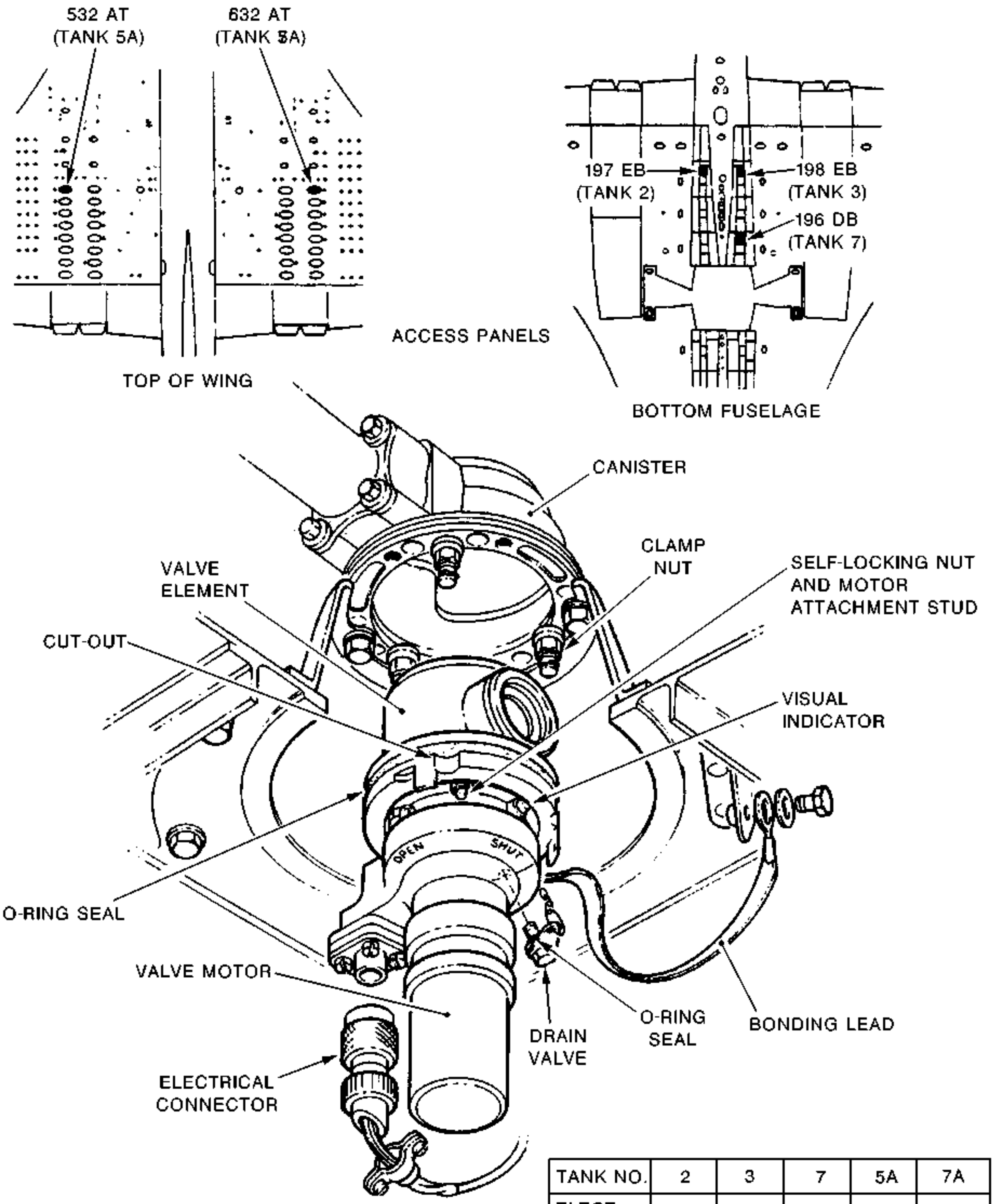
2. Valve Element (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 1 pint (0.568 l) capacity	-

B. Prepare to Remove Valve Element

(1) Ensure that all fuel management panel switches are at their normal ground settings. Display a placard warning that the settings of the switches must not be changed.



TANK NO.	2	3	7	5A	7A
ELECT. IDENT.	Q627	Q626	Q620	Q629	Q628
VALVE IDENT. AND ASSOCIATED TANK NOS.					

CMB 28 24 11 4 AAM0 00

Valve Element - Installation
Figure 401

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(2) Electrically isolate the refuel tank inlet valve by tripping the appropriate circuit breaker. Fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 2 REFUEL VALVE SUP	15-216	Q 524	F10
TANK 3 REFUEL VALVE SUP	15-216	Q 523	F 3
TANK 7 REFUEL VALVE SUP	15-215	Q 517	F21
TANK 5A REFUEL VALVE SUP	15-216	Q 526	F 4
TANK 7A REFUEL VALVE SUP	15-216	Q 525	F 5

(3) Gain access to the valve element by removing the appropriate access panel (Ref. Fig.401).

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C. Remove Valve Element

(1) Remove the bolt and washer securing the bonding lead to the structure.

(2) Disconnect the electrical connector from the valve element.

CAUTION: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMPING NUT STUDS, DO NOT SLACKEN THE CLAMPING NUTS MORE THAN TWO TURNS.

(3) Slacken the clamp nuts by not more than two turns.

(4) Position the container under the drain plug and remove the drain plug.

NOTE: The drain plug must be removed before the valve element is rotated, otherwise the drain plug locking plate will foul the clamping nuts.

(5) Rotate the valve element clockwise through 90 deg and align the cut-outs in the valve body with the clamp nuts.

NOTE: Some fuel will drain when the element is rotated.

(6) Immediately pull the valve element from the canister. Refit the drain plug to the valve element.

(7) Remove and discard the O-ring seal from the valve element.

(8) Fit a suitable blank to the canister aperture.

D. Prepare to Install Valve Element

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the drain plug and fit a new O-ring seal. Do not refit the drain plug at this stage.

(2) Fit a new O-ring seal to the valve element.

(3) Remove the blank from the canister aperture.

E. Install Valve Element

(1) Comply with the electrical and fuel safety precautions.

(2) Insert the valve element into the canister. Ensure that the valve body cut-outs are aligned with the clamp nuts, then push the valve element firmly and fully into the canister.

(3) Rotate the valve element counter-clockwise through 90 deg.

(4) Torque-tighten the clamp nuts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Fit the drain plug and torque-tighten to between 10 and 14 lbf in (0.113 and 0.158 mdaN).

(6) Secure the bonding lead to the structure bracket with the washer and bolt. Torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(7) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

(8) Check the bonding of the valve element installation in accordance with 20-27-11.

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F. Conclusion

(1) Reset the circuit breaker tripped before removal.

(2) Perform a Function Test of the valve (Ref. Adjustment/Test).

(3) Refit the access panel (Ref. Fig.401) as detailed in 53-00-00, Removal/Installation.

(4) Remove the warning placard.

3. Valve Motor (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Remove the valve element (Ref. para.2.).

C. Remove Valve Motor

(1) Remove the self-locking nuts securing the motor to the studs on the valve body. Support the valve motor and disconnect the bonding lead.

(2) Remove the motor by disengaging the valve drive shaft from the motor coupling.

D. Prepare to Install Valve Motor

(1) Check that the mating surface of the valve and motor are clean and undamaged and that the splines on the drive shaft and motor coupling are free from damage.

E. Install Valve Motor

(1) Align the master spline of the motor drive shaft with the master spline of the motor coupling and insert the drive shaft into the coupling. Ensure that the locating dowel is correctly engaged.

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(2) Attach the bonding lead to the appropriate stud and fit a self-locking nut to each stud. Torque-tighten each nut to between 28 and 32 lbf in (0.316 and 0.362 mdaN) in accordance with 20-21-11. Check that the bonding is in accordance with 20-27-11.

F. Conclusion

(1) Install the valve element (Ref. para.2.).

4. Canister - Tanks 2, 3 and 7 (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Torque spanner, 60 to 72 lbf in (0.678 to 0.813 mdaN)	-
Container, 1 gal (4.55 l) capacity, for fuel spillage	-
Container, 10 gal (45 l) capacity, for fuel spillage	-
Container, 50 gal (227 l) capacity, for fuel spillage	-
Bonding cable, for fuel spillage container	-
Adapter, fuel overflow pipe	E925127000
Hose, 3 in (76.2 mm) ID	-
Circuit breaker safety clips	-

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B. Prepare to Remove Canister - Tank 2, 3 or 7

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Defuel the associated tank (Ref. 28-25-00, Servicing).

NOTE: As the scavenge pump returns fuel to tank 3, when draining the trim transfer pipe, different draining procedures are required for canister installations. Carry out operation (4) or (5) as applicable.

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

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(4) Tank 2 or 7 installation: drain the trim transfer pipe as follows:

(a) Set the associated refuel tank inlet valve switch open.

(b) Position the 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(c) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(d) Set the TRIM PIPE DRAIN switch to "OPEN".

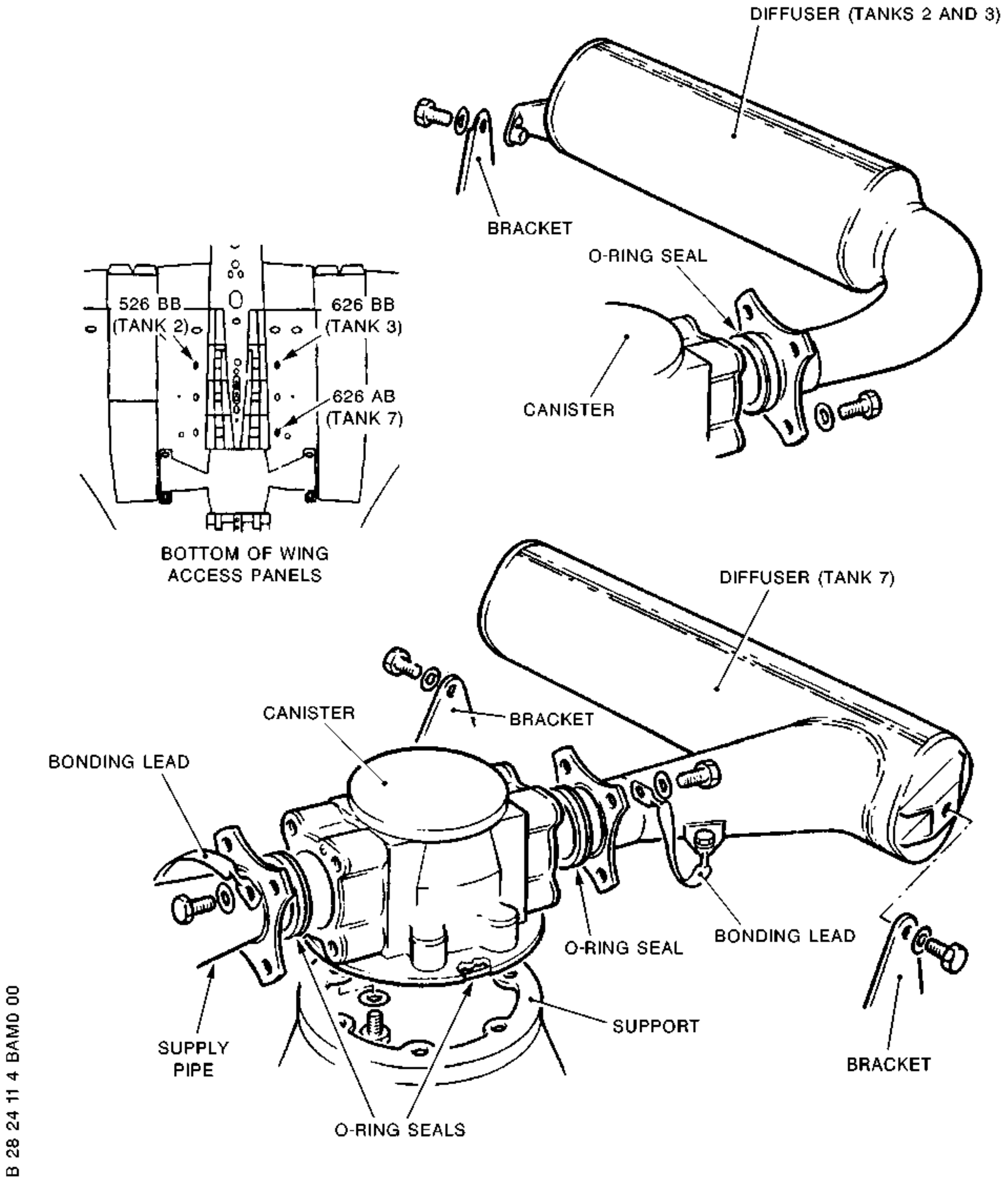
NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(e) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(f) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

After SB 28-020 For A/C 001-004,

(f) Set the JETTISON MASTER VALVES switches to "OFF". Ensure that the associated magnetic indicators display bar-across-line.



Valve Canister, Tanks 2, 3 and 7 - Installation
Figure 402

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(g) Set the refuel tank inlet valve switch to "SHUT".

(h) Remove the container.

(5) Tank 3 installation: drain the trim transfer pipe as follows:

(a) Set the associated refuel tank inlet valve switch open.

(b) Remove the bung from the fuel overflow pipe adapter and fit the hose to the adapter.

(c) Position the 50 gal (227 l) container under the overflow relief valve (ORV) outlet. Electrically bond the container to the aircraft.

(d) Fit the adapter to the ORV outlet and position the hose in the container.

(e) Inhibit the operation of the scavenge pump by tripping the circuit breakers. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q 491	E 4
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

(f) Position the 10 gal (45 l) container at the fuel jettison outlet.

(g) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(h) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: Fuel draining into the scavenge tank will activate the ORV sensors, causing the ORV to open and allow fuel to drain from the scavenge tank into the container.

(j) When fuel starts to drain into the container, keep the ORV open, by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q271, on panel 1-213, map ref. K15.

(k) Wait until the fuel draining stops, then set the TRIM PIPE DRAIN switch to "SHUT".

(l) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

After SB 28-020 For A/C 001-004,

(l) Set the JETTISON MASTER VALVES switches to "OFF". Ensure that the associated magnetic indicators display bar-across-line.

(m) Set the refuel tank inlet valve switch to "SHUT".

(n) Reset the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721, on panel 1-213, map ref. K15. Check that the ORV closes.

WARNING: TO PREVENT INADVERTENT OPERATION OF THE SCAVENGE PUMP, DO NOT RESET THE SCAVENGE PUMP CIRCUIT BREAKERS.

(p) Remove the containers.

(6) Attach warning placards to the fuel management and refuel control panels, indicating that the settings of the switches must not be changed.

(7) Remove the associated tank access panel (Ref. Fig.402) and prepare the tank for entry (Ref. 28-10-00, Servicing).

(8) Remove the valve element (Ref. para.2.).

C. Remove Canister - Tank 2, 3 or 7

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

NOTE: During removal of the components and attaching parts, the position of the special earthing bolts must be noted.

(1) Remove the bolts and washers securing the diffuser to the brackets.

NOTE: The diffusers in tanks 2 and 3 are each secured by one bolt. The diffuser in tank 7 is secured by two bolts.

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(2) Remove the bolts and washers securing the diffuser to the canister. Remove the diffuser and remove and discard the O-ring seal. Fit a suitable blank to the diffuser pipe end.

NOTE: The bonding lead is attached by one of the bolts securing the diffuser to the canister. Both the bolt and its position must be noted and the bolt replaced in this position on installation.

(3) Remove the bolts and washers securing the canister and bonding lead to the supply pipe flange. Note the position of the bonding bolt, for use on installation.

(4) Remove the bolts and washers securing the canister to the support and remove the canister.

(5) Remove and discard the O-ring seals from the canister base and the supply pipe flange. Fit suitable blanks to the canister and supply pipe end.

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D. Install Canister - Tank 2, 3 or 7

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the blanks from the canister and supply pipe end.

(2) Check that the canister sleeve is in the SHUT position and fit a new O-ring seal in the base of the canister and in the groove in the supply pipe flange.

(3) Fit the canister in position and insert the supply pipe end and O-ring seal into the canister inlet port. Check that the O-ring seal in the groove at the base of the canister is correctly seated on the support.

(4) Secure the canister to the support with the washers and bolts, ensuring that the special earthing bolt is in its correct position, as noted during removal. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) in accordance with 20-21-11.

(5) Secure the canister to the supply pipe with the washers and bolts, ensuring that the bonding lead is attached with the special bolts and that the bonding is in accordance with 20-27-11.

(6) Remove the blank from the diffuser pipe end and fit a new O-ring seal in the groove in the pipe end.

(7) Secure the diffuser to the canister with the washers and bolts, ensuring that the bonding lead is attached with the special bolt. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) in accordance with 20-21-11. Check that the bonding is in accordance with 20-27-11.

(8) Secure the diffuser to the brackets with the washers and bolts. Torque-tighten the bolts to between 60 and 70 lbf in (0.678 and 0.791 mdaN) in accordance with 20-21-11.

NOTE: The diffusers in tanks 2 and 3 are each secured by one bolt. The diffuser in tank 7 is secured by two bolts.

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E. Conclusion

(1) Install the valve element (Ref. para.2.).

(2) Carry out a Leak Test - Valve Canister (Ref. Adjustment/Test).

R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Refit the tank access panel (Ref. 57-00-00, Removal/ Installation).

R (5) If the scavenge pump circuit breakers were tripped in operation 4.B., remove the safety clips and reset the circuit breakers.

R (6) Refuel the tank (Ref. 28-25-00, Servicing).

R (7) Check that there are no fuel leaks from the base of the canister and the tank access panel.

R (8) Refit the valve element access panel (Ref. 53-00-00, Removal/Installation).

R (9) Remove the warning placards from the fuel management and refuel control panels.

5. Canister - Tanks 5A and 7A (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 10 gal (45 l) capacity, for fuel spillage	-
Capacity, 1 gal (4.5 l) capacity, for fuel spillage	-

B. Prepare to Remove Canister - Tank 5A or 7A

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Defuel the associated tank (Ref. 28-25-00, Servicing).

NOTE: Tank 6 contains the canister for tank 5A, and tank 7 contains the canister for tank 7A.

CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS (REF. 28-00-00, SERVICING - TECHNICAL PRECAUTIONS).

(4) Set the associated refuel tank inlet valve open. Drain the trim transfer pipe of fuel as follows:

(a) Position the 10 gal (45 l) container at the fuel jettison outlet, to collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

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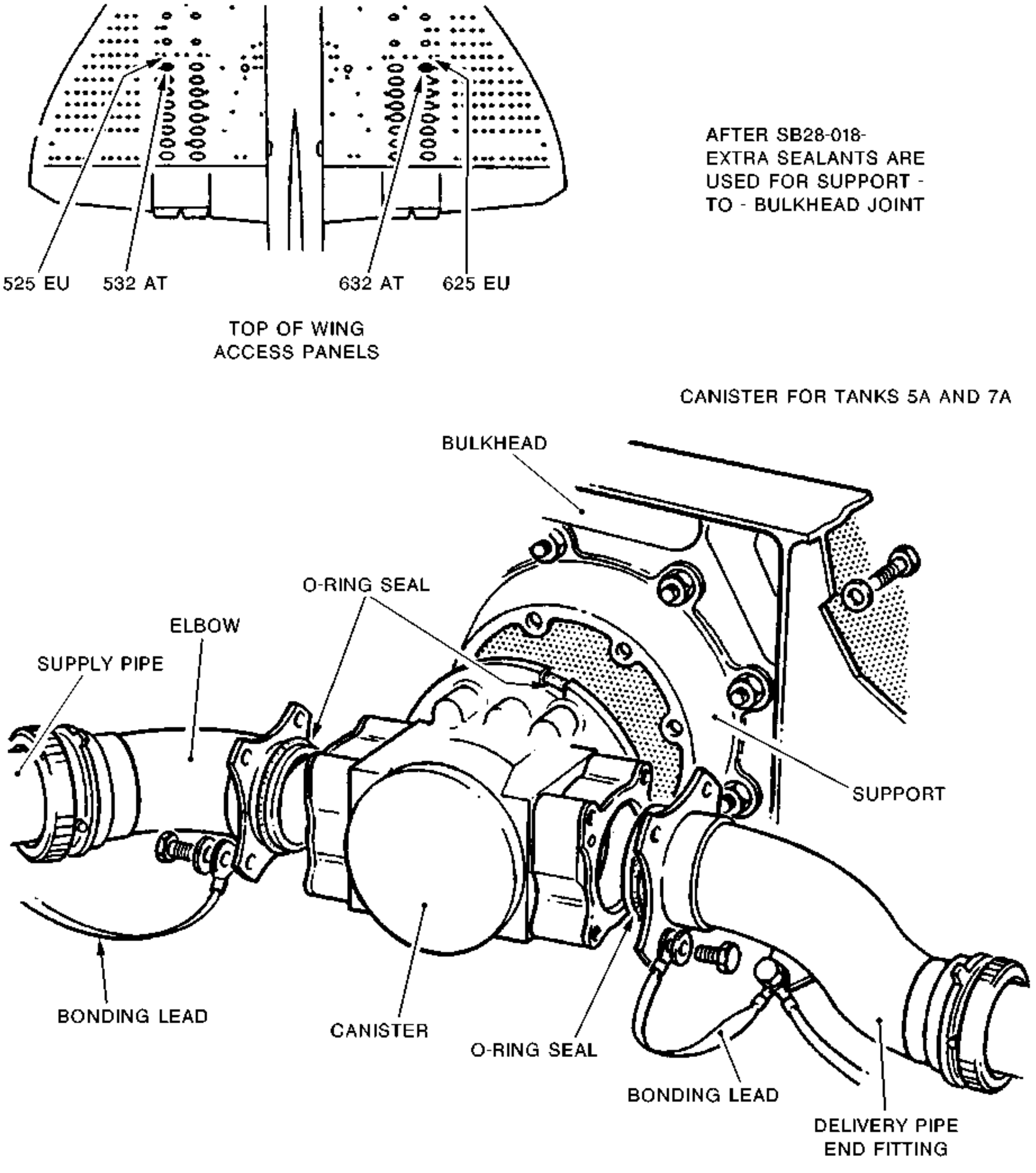

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Valve Canister, Tanks 5A and 7A - Installation
Figure 403

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(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

After SB 28-020 For A/C 001-004,

(e) Set the JETTISON MASTER VALVES switches to "OFF". Ensure that the associated magnetic indicators display bar-across-line.

(f) Set the associated refuel tank inlet valve switch to "SHUT".

(g) Remove the container.

(5) Attach warning placards to the fuel management and refuel control panels, indicating that the settings of the switches must not be changed.

(6) Remove the associated tank access panel (Ref. Fig.403) and prepare the tank for entry (Ref. 28-10-00, Servicing).

(7) Remove the valve element (Ref. para.2.).

C. Remove Canister - Tank 5A or 7A

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

NOTE: During the removal of the components and attaching parts, the position of the special earthing bolts must be noted.

(1) Remove the bolts and washers securing the supply pipe to the canister. Remove the bonding lead and note the position of its securing bolt.

(2) Remove the bolts and washers securing the delivery pipe to the canister. Remove the bonding lead and note the position of the bolt securing the bonding lead.

(3) Remove the bolts and washers securing the canister to the support and remove the canister.

NOTE: The supply and delivery pipes must be displaced no further than is necessary to allow removal of the canister.

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(4) Remove and discard the O-ring seal from the canister base, supply pipe elbow and delivery pipe end fitting.

(5) Fit suitable blanks to the supply pipe and delivery pipe ends.

D. Install Canister - Tank 5A or 7A

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the blanks from the supply pipe and delivery pipe ends.

(2) Check the mating surfaces of the canister, support and end fittings for cleanliness and freedom from damage.

(3) Fit new O-ring seals in the base of the canister and in the grooves in the supply pipe and delivery pipe ends.

(4) Fit the canister in position and slide the supply and delivery pipe ends, complete with O-ring seals, into the canister end fittings.

NOTE: The supply and delivery pipes must be displaced no more than is necessary to allow installation of the canister.

(5) Secure the canister to the support with the washers and bolts, ensuring that the special earthing bolt is in the position noted before removal. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) in accordance with 20-21-11.

(6) Secure the supply pipe to the canister and connect the bonding lead with the washers and bolts. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) in accordance with 20-21-11.

(7) Secure the delivery pipe to the canister and connect the bonding lead with the washers and bolts. Torque-tighten the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN) in accordance with 20-21-11.

(8) Check the bonding of the installation in accordance with 20-27-11.

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E. Conclusion

(1) Install the valve element (Ref. para.2.).

(2) Carry out a Leak Test - Valve Canister (Ref. Adjustment/Test).

R (3) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (4) Refit the tank access panel (Ref. 57-00-00, Removal/Installation).

R (5) Refuel the tank (Ref. 28-25-00, Servicing).

R (6) Check that there are no fuel leaks from the base of the canister and the tank access panel.

R (7) Refit the valve element access panel (Ref. Fig.401) as detailed in 57-00-00, Removal/Installation.

R (8) Remove the warning placards from the fuel management and refuel control panels.

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REFUEL TANK INLET VALVE (1 in) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are five 1 in refuel tank inlet valves which control the refuelling of tanks 2, 3, 5A, 7 and 7A. Each valve assembly is fitted in its associated tank, except those for tanks 5A and 7A which are mounted in tanks 6 and 7 respectively.

The control switches are located on the refuel control panel and each switch has two settings, OPEN and SHUT. Each switch is normally set to SHUT.

The valves for tanks 2, 3 and 7 may also be operated by using the STANDBY INLET VALVES switches on the fuel management panel at the third crew member's (3CM) position. Each of these switches has two settings, OPEN and SHUT, and is normally set to SHUT.

The following procedures comprise Functional and Leakage Tests of the valve element and a Leakage Test of the valve canister. Operational and System Tests are not applicable. If the valve motor has been replaced, only the valve element Functional Test is required.

2. Functional Test - Valve Element

A. Prepare to Test Valve Element

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches (3CM position) are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Remove the appropriate valve element access panel (Ref. Removal/Installation).

(4) Open the refuel control panel access door in the underwing fairing, and set the refuel master switch to "SET UP".

(5) Ensure that the tank has sufficient capacity to

receive the fuel for the fuel flow test (Ref. para.B.(6)).

B. Test Valve Element

(1) On the refuel control panel, set the appropriate refuel tank inlet valve switch to "OPEN" and check that -

(a) the valve opens within 2 s of the operation of the switch,

(b) the associated magnetic indicator display on the refuel control panel changes from black to yellow, and

(c) the visual indicator on the valve indicates OPEN.

(2) Set the switch to "SHUT" and check that -

(a) the valve shuts within 2 s of the operation of the switch,

(b) the associated magnetic indicator display changes from yellow to black, and

(c) the visual indicator on the valve indicates SHUT.

(3) Set the refuel master switch to "OFF-DEFUEL" and close the refuel control panel access door.

(4) On the fuel management panel (3CM position), for a tank 2, 3 or 7 refuel inlet valve, set the appropriate STANDBY INLET VALVES switch to "OPEN" and check that -

(a) the valve opens within 2 s of the operation of the switch,

(b) the mechanical indicator on the valve indicates OPEN, and,

(c) when a valve in tank 2 or 3 is under test, the associated magnetic indicator display changes
R from SHUT to diagonal stripes, and then to OPEN.

(5) Set the switch to "SHUT" and check that -

(a) the valve shuts within 2 s of the operation of the switch,

(b) the mechanical indicator on the valve indicates

SHUT, and,

(c) if applicable, the magnetic indicator display changes from OPEN to diagonal stripes, and then to SHUT.

(6) Refuel the tank (Ref. 12-11-28) and check that the fuel flow rate into the tank is in accordance with Table 501.

TANK NO.	FUEL FLOW RATE AT MAX. REFUELLING PRESSURE OF 55 psig (3.795 bar)	
	gal (Imp.)/min	l/min
2	68 to 78	309 to 354
3	53 to 59	241 to 268
5A	58 to 66	264 to 300
7	124 to 140	564 to 636
7A	41 to 45	186 to 205

Fuel Flow Rates
Table 501

C. Conclusion

(1) Refit the access panel removed before the test.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test - Valve Element

A. Prepare to Test Valve Element

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches (3CM position) are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that tank 9 contains at least 1,000 kg of fuel to make the test.

(4) Remove the appropriate valve element access panel (Ref. Removal/Installation).

(5) Open the refuel control panel access door.

B. Test Valve Element

(1) On the fuel management panel, set the appropriate tank 9 PUMP switch (LH or RH) to "ON" to pressurize the LH or RH trim system with fuel. Check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up.

(2) Check that there is no external leakage of fuel from the valve element and that no fuel is being transferred into the tank associated with the valve.

(3) On the refuel control panel, set the refuel master switch to "SET UP" and the switch for the valve to "OPEN". Check that there is no external leakage from the valve element. Set the valve switch to "SHUT".

(4) Set the PUMP switch to "OFF".

(5) Set the refuel master switch to "OFF-DEFUEL".

C. Conclusion

(1) Refit the access panel removed before the test.

(2) Close the refuel control panel access door.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test - Valve Canister

A. Prepare to Test Valve Canister

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Open the access door and ensure that all refuel inlet valve switches on the refuel control panel are set to SHUT.

(4) Place placards on both panels warning that the positions of the switches must not be altered.

(5) Remove the appropriate valve element access panel (Ref. Removal/Installation).

NOTE: The valve element must be installed for the purpose of this test.

(6) Defuel and drain the tank containing the canister under test (Ref. 28-25-00, Servicing).

(7) Remove the appropriate tank access panel (Ref. Removal/Installation) to gain access to the canister.

B. Test Valve Canister

(1) On the fuel management panel, set the appropriate tank 9 PUMP switch (LH or RH) to "ON" to pressurize the LH or RH trim system with fuel. Check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up.

WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(2) Enter the tank and check, over a minimum period of 5 min, that there is no fuel leakage from the pipe-to-canister and canister-to-tank connections.

(3) Set the PUMP switch to "OFF".

(4) Refit the tank access panel in accordance with 53-00-00 or 57-00-00, Removal/Installation.

R CAUTION: OBSERVE THE FUEL DISTRIBUTION SAFETY PRECAUTIONS
R DETAILED IN 12-00-10, AIRCRAFT GROUND STABILITY.

(5) Refuel the tank (Ref. 12-11-28) to high level and check that there is no external fuel leakage from the tank access panel joint.

NOTE: The following operations, (6), (7) and C.(1), need only be carried out if it is required to check the sealing of the canister isolation sleeve. This is not necessary if a new canister has been fitted.

(6) Remove the valve element (Ref. Removal/Installation).

(7) Check that the rate of fuel leakage from the canister

does not exceed 7.6 cc/min.

C. Conclusion

(1) Install the valve element (Ref. Removal/Installation).

(2) Carry out a Functional and a Leakage Test of the valve element (Ref. paras.2. and 3.).

(3) Remove the placards from the fuel management panel and the refuel control panel. Close the access door.

REFUEL TANK INLET VALVE (2 in) WITH NON-RETURN VALVE - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN
R 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are seven 2 in refuel tank inlet valves which control the refuelling of tanks 1, 4, 5, 6, 8, 9 and 10. Each valve assembly consists of a motorized valve element mounted in a canister which allows the element to be removed without defuelling the associated tank. To remove the canister it is necessary to defuel and enter the tank. Each canister is mounted in its associated tank, except the canister for tank 9, which is mounted in tank 10. Access to each valve element is provided by its associated access panel in the underwing fairing. Flow restrictors are formed in most pipe-to-canister fittings.

2. Valve Element (Ref. Fig. 401)

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
R R Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
R R Container, 2 pints (1.136 l) capacity	-

B. Prepare to Remove Valve Element

(1) Ensure that all the fuel management panel switches
R are at their normal ground settings and all
R refuel valve control switches on the refuel
R control panel are set to SHUT. Place warning
R placards on the appropriate panels indicating
R that the settings of these switches must not be

changed.

R (2) Trip the associated valve circuit breaker and fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL VALVE SUP			
TANK 9	15-216	Q515	F9
TANK 10	15-215	Q516	E22
TANK 1	15-215	Q522	E23
TANK 4	15-215	Q521	E24
TANK 5	15-215	Q518	E25
TANK 8	15-215	Q519	F19
TANK 6	15-215	Q520	F20

R (3) Remove the appropriate access panel (Ref. Fig. 401).

C. Remove Valve Element

(1) Disconnect the electrical connector from the valve motor. Note the position of the electrical connector of the valve motor, in relation to the structure.

(2) Remove the bolt and washer securing the bonding lead to the structure. Remove the lead and tape it to the valve.

(3) Position a suitable container to collect fuel drained from the valve.

R
R
R
CAUTION: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMP NUT STUDS, DO NOT SLACKEN THE CLAMP NUTS MORE THAN TWO TURNS.

(4) Slacken the three clamp nuts between 1 1/2 and 2 turns only. Rotate the valve element clockwise through 90 deg.

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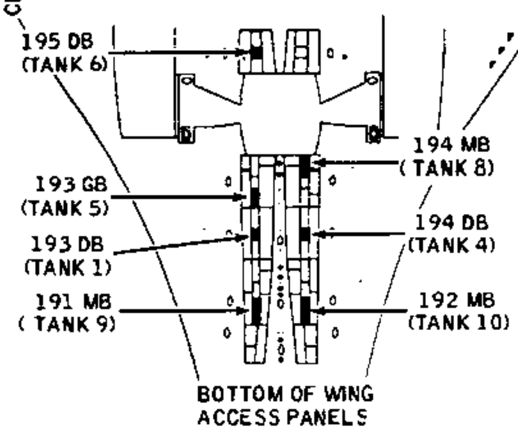
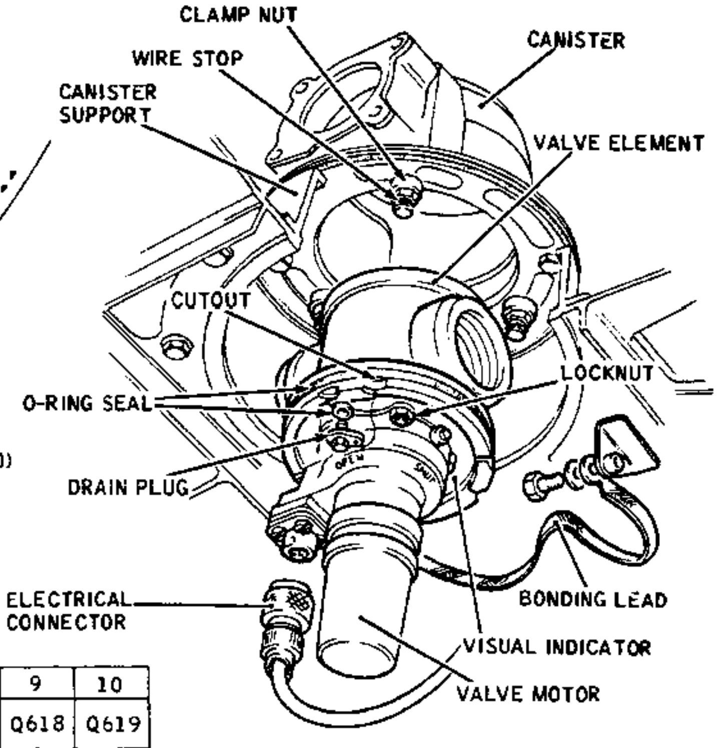
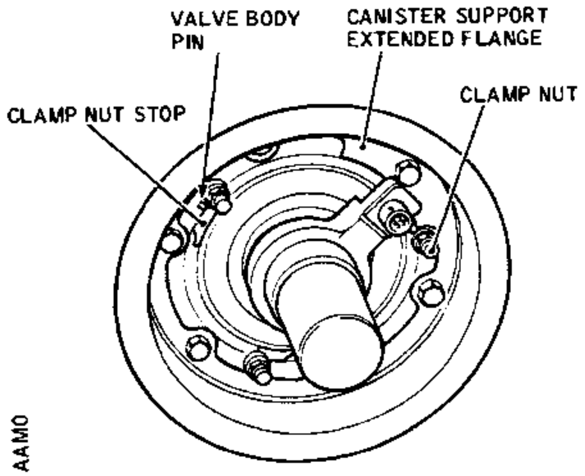
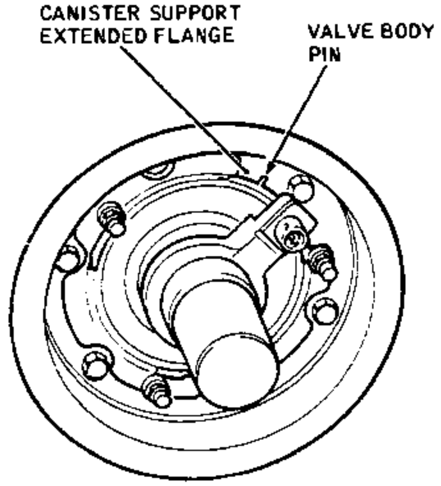




TANK NO.	1	4	5	6	8	9	10
ELECT. IDENT.	Q625	Q624	Q621	Q623	Q622	Q618	Q619
ELECTRICAL IDENT. AND ASSOCIATED TANK NOS.							



VIEW SHOWING INSERTION OF CORRECT VALVE ELEMENT BEFORE 90 deg COUNTER-CLOCKWISE ROTATION.



VIEW SHOWING INSERTION OF INCORRECT VALVE ELEMENT. NOTE THAT PIN FOULS FLANGE AND PREVENTS FULL INSERTION OF VALVE ELEMENT.

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Valve Element - Installation
Figure 401

R

(5) Remove the drain plug and discard the seal. Drain the fuel (approximately 1 pint (0.568 l) from the valve interior. Leave out the drain plug, to prevent an air lock between the valve element and canister, during withdrawal of the element.

(6) With the valve cut-outs aligned with the clamps, withdraw the valve element from the canister.

R (7) Fit a suitable blank to the canister aperture.

R (8) Remove and discard the O-ring seal from the valve element.

R (9) Refit the drain plug temporarily.

R D. Prepare to Install Valve Element

R (1) Remove the drain plug and fit a new O-ring seal,
R lubricated in accordance with 20-23-11; refit
R the drain plug, hand-tight only.

R (2) Fit a new O-ring seal, lubricated in accordance with
R 20-23-11, to the valve element.

R (3) Remove the blank from the canister aperture.

R E. Install Valve Element

R (1) Comply with the fuel and electrical safety
R precautions.

R (2) Insert the valve element into the canister, ensuring that the cut-outs are correctly aligned with the clamps. If, during assembly, a baulking pin in the
R periphery of the valve element body fouls an
R extension on the top flange of the canister support
R (Ref. Fig. 401), remove the valve element and check the canister for correct installation and the valve element for applicability.

(3) Rotate the valve counter-clockwise through 90 deg to align the recesses with the clamps; secure the element with the clamp nuts. Torque-tighten each nut
R to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

R (4) Check that the position of the electrical connector on the valve motor coincides with that noted in operation C.(1). Connect the electrical connector to the valve motor, ensuring that the mating surfaces are clean and undamaged.

R (5) Torque-tighten the drain plug to between 10 and
R 14 lbf in (0.113 and 0.158 mdaN).

R (6) Secure the bonding lead to the structure with the bolt and washer, and check that the valve element is bonded in accordance with 20-27-11.

R F. Conclusion

R (1) Remove the warning placards from the panels and
R reset the circuit breakers previously tripped.

R (2) Carry out a Functional Test and a Leakage Test of the valve element (Ref. Adjustment/Test).

3. Valve Motor (Ref. Fig. 401)

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

R R R

B. Prepare to Remove Motor

(1) Remove the valve element (Ref. para.2.).

C. Remove Motor

(1) Remove the locknuts securing the motor to the four studs on the body of the valve, and remove the bonding lead from the stud.

(2) Remove the motor, disengaging the valve drive shaft from the motor coupling.

D. Install Motor

(1) Check that the mating faces of the valve and motor are clean and undamaged and that the splines on the drive shaft and motor coupling are clean and free from burrs.

(2) Align the master spline of the valve drive shaft with the master spline of the motor coupling and insert the drive shaft into the coupling. Locate the motor on the valve by the locating dowel at the joint face and by the four studs.

(3) Attach the bonding lead to a stud.

(4) Fit the locknuts to the studs; torque-tighten each locknut to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

E. Conclusion

(1) Install the valve element (Ref. para.2.).

4. <u>Canister (Tanks 1, 4, 5, 6 and 8)</u> (Ref. Fig. 402) (Detail A)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Container, 10 gal (45 l)	-

B. Prepare to Remove Canister (Tank 1, 4, 5, 6 or 8)

(1) Remove the valve element (Ref. para.2.).

(2) Defuel the associated tank (Ref. 28-25-00, Servicing).

(3) Remove the appropriate access panel (Ref. Fig. 402).

<u>CAUTION:</u> OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS AS DETAILED IN 28-00-00, SERVICING, TECHNICAL PRECAUTIONS.

(4) Drain any residual fuel from the trim transfer pipes as follows:-

(a) Position the 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

R (c) Set the TRIM PIPE DRAIN switch to "OPEN".

R NOTE: The SCAVENGE PUMP indicator will
R display ON as fuel drains into the
R scavenge tank.

R (d) Wait until the scavenge pump indicator
R displays OFF, then set the TRIM PIPE DRAIN
R switch to "SHUT".

R (e) Set the JETTISON MASTER VALVES switches to
R "SHUT", wait until the associated magnetic
R indicators display bar-across-line, then
R set the switches to "OFF".

R (f) Remove the container.

C. Remove Canister (Tank 1, 4, 5, 6 or 8)

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

NOTE: During removal of components and attaching parts,
R the position of special bonding bolts must be
noted.

(1) Remove the bolt and washer securing the diffuser to the bracket.

(2) Remove the bolts and washers securing the diffuser to the canister; remove the diffuser. Remove and discard the O-ring seal from the diffuser flange and fit a suitable blank.

(3) Remove the bolts and washers securing the canister to the bobbin; note the position of the bonding lead and its attachment bolt at the flange.

(4) Remove the bolts and washers securing the canister to the support; remove the canister. Remove and discard the O-ring seals from the canister base and the bobbin flange. Fit suitable blanks to the canister and bobbin.

D. Install Canister (Tank 1, 4, 5, 6 or 8)

CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING
R PARTS, ENSURE THAT THESE ITEMS ARE BONDED
R IN ACCORDANCE WITH 20-27-11.

NOTE: Before assembly, O-ring seals must be lubricated

R in accordance with 20-23-11.

(1) Remove the blanks from the canister and bobbin. Ensure that the canister sleeve is in the shut position. Check that the mating surfaces of the bobbin and canister are clean and undamaged and fit new O-ring seals to the bobbin flange and the canister base.

R CAUTION: DURING OPERATIONS (2) TO (4) ENSURE THAT THE SPECIAL BONDING BOLTS ARE FITTED IN THEIR CORRECT POSITIONS.

(2) Loosely assemble the canister to the bobbin on the supply pipe with the bolts and washers; ensure that the bonding lead is connected by its special attachment bolt at the canister flange in accordance with 20-27-11.

NOTE: If the canister is not positioned correctly, an extension of the top flange of the canister support will foul one of the clamp nuts on the canister.

(3) Remove the blank from the diffuser and check that the mating surfaces of the canister and diffuser are clean and undamaged. Fit a new O-ring seal to the diffuser flange and loosely assemble the diffuser to the canister with the bolts and washers.

(4) Secure the canister to the support with the bolts and washers. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Torque-tighten each bolt securing the bobbin on the supply pipe to the canister to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(6) Torque-tighten each bolt securing the diffuser to the canister to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(7) Secure the diffuser to the bracket with the bolt and washer. Torque-tighten the bolt to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

R (8) Check that the components that have been disturbed
R are bonded in accordance with 20-27-11.

R E. Conclusion

R (1) Carry out a Leakage Test of the canister

(Ref. Adjustment/Test).

5. Canister (Tanks 9 and 10) (Ref. Fig. 402) (Detail B)

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 10 gal (45 l)	-

B. Prepare to Remove Canister (Tank 9 or 10)

(1) Remove the valve element (Ref. para.2.).

(2) Defuel the associated tank (Ref. 28-25-00, Servicing).

NOTE: For tank 9 valve it will be necessary to defuel tank 10 also, since the canister is located in this tank.

(3) Remove the appropriate access panel (Ref. Fig. 402).

R CAUTION: OBSERVE THE TRIM PIPE DRAINING PRECAUTIONS AS DETAILED IN 28-00-00, SERVICING, TECHNICAL PRECAUTIONS.

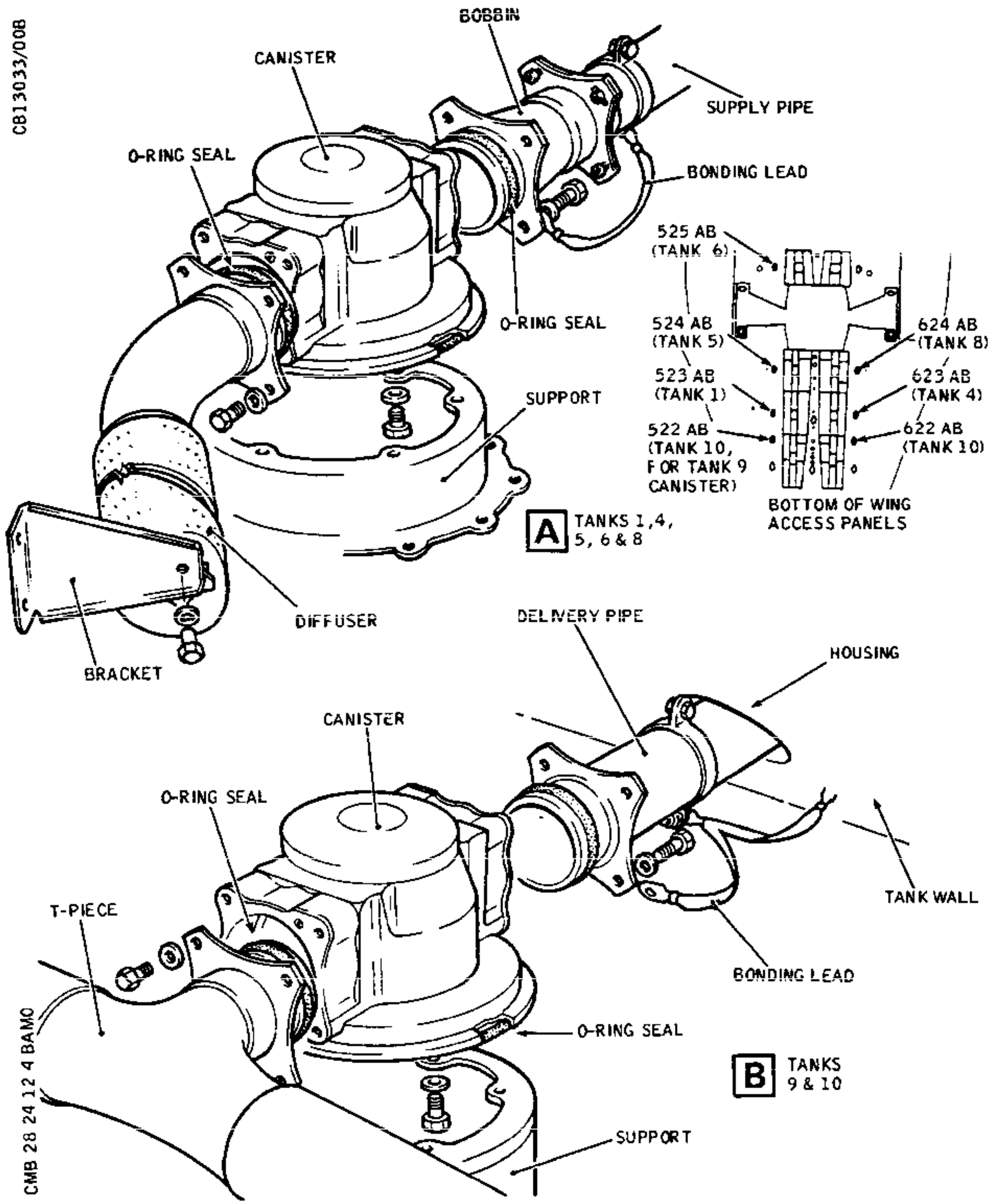
R (4) Drain any residual fuel from the trim transfer pipes as follows:-

R (a) Position the 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

R (b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

R (c) Set the TRIM PIPE DRAIN switch to "OPEN".

R NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.



R Canister - Installation
Figure 402

R (d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

R (e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

R (f) Remove the container.

C. Remove Canister (Tank 9 or 10)

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

R NOTE: During removal of components and attaching parts, the position of special bonding bolts must be noted.

(1) Remove the bolts and washers securing the delivery pipe and bonding lead to the canister; note the position of the bonding lead and its attachment bolt at the flange. Slide the delivery pipe into the housing in the tank wall as far as possible.

(2) Remove the bolts and washers securing the canister to the T-piece.

(3) Remove the bolts and washers securing the canister to the support; remove the canister. Remove and discard the O-ring seals from the T-piece, delivery pipe and canister base. Fit suitable blanks to the T-piece, delivery pipe and canister.

D. Install Canister (Tank 9 or 10)

R CAUTION: DURING INSTALLATION OF COMPONENTS AND ATTACHING PARTS, ENSURE THAT THESE ITEMS ARE BONDED IN ACCORDANCE WITH 20-27-11.

R NOTE: Before assembly, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the blanks from the T-piece, delivery pipe and valve canister.

(2) Check that the mating surfaces of the T-piece and canister are clean and undamaged, then fit a new O-ring seal to the T-piece flange.

(3) Check that the mating surfaces of the canister and support are clean and undamaged, then fit a new O-ring seal to the canister base.

(4) Check that the mating surfaces of the canister and delivery pipe are clean and undamaged, then fit a new O-ring seal to the delivery pipe flange.

R CAUTION: DURING OPERATIONS (5) TO (7) ENSURE THAT THE SPECIAL BONDING BOLTS ARE FITTED IN THEIR CORRECT POSITIONS.

(5) Ensure that the canister sleeve is in the shut position, then loosely assemble the canister to the T-piece with the washers and bolts.

NOTE: If the canister is not positioned correctly, an extension of the top flange of the canister support will foul one of the clamp nuts on the canister.

(6) Slide the delivery pipe into the canister and loosely attach it with the washers and bolts; ensure that the bonding lead is connected by its special attachment bolt to the canister flange in accordance with 20-27-11.

(7) Secure the canister to the support with the washers and bolts. Torque-tighten each bolt to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(8) Torque-tighten each bolt securing the canister to the T-piece to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(9) Torque-tighten each bolt securing the canister to the delivery pipe to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

R (10) Check that each component that has been disturbed
R is bonded in accordance with 20-27-11.

R E. Conclusion

R (1) Carry out a Leakage Test of the canister (Ref. Adjustment/Test).

REFUEL TANK INLET VALVE (2 in) - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are seven 2 in refuel tank inlet valves which control the refuelling of tanks 1, 4, 5, 6, 8, 9 and 10. Each valve assembly is fitted in its associated tank, except the tank 9 valve which is fitted in tank 10. The valve element incorporates a non-return valve to prevent gravity fuel flow out of the tank, and hence possible aircraft overbalance, should a valve be opened inadvertently when the aircraft is on the ground.

The control switches are located on the refuel control panel and each switch has two settings, OPEN and SHUT. Each switch is normally set to SHUT.

The valves for tanks 1, 4, 5, 6, 8 and 10 may also be operated by using the STANDBY INLET VALVES switches on the fuel management panel at the third crew member's (3CM) position. Each of these switches has two settings, OPEN and SHUT, and is normally set to SHUT.

The following procedures comprise Functional and Leakage Tests of the valve element and a Leakage Test of the valve canister. Operational and System Tests are not applicable. If the valve motor has been replaced, only the valve element Functional Test is required.

Tank 11 LH trim inlet valve has a dual function in that it is also used as a refuel tank inlet valve. Test procedures for this valve are detailed in 28-23-21, Adjustment/Test.

2. Functional Test - Valve Element

A. Prepare to Test Valve Element

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches (3CM position) are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Remove the appropriate valve element access panel (Ref. Removal/Installation).

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(4) Open the refuel control panel access door in the underwing fairing, and set the refuel master switch to "SET UP".

(5) Ensure that the tank has sufficient capacity to receive the fuel for the fuel flow test (Ref. para.B.(6)).

B. Test Valve Element

(1) On the refuel control panel, set the appropriate refuel tank inlet valve switch to "OPEN" and check that:

(a) the valve opens within 2 s of the operation of the switch,

(b) the associated magnetic indicator display on the refuel control panel changes from black to yellow, and

(c) the visual indicator on the valve indicates OPEN.

(2) Set the switch to "SHUT" and check that:

(a) the valve shuts within 2 s of the operation of the switch,

(b) the associated magnetic indicator display changes from yellow to black, and

(c) the visual indicator on the valve indicates SHUT.

(3) Set the refuel master switch to "OFF-DEFUEL" and close the refuel control panel access door.

(4) On the fuel management panel (3CM position), except during a test of tank 9 inlet valve, set the appropriate STANDBY INLET VALVES switch to "OPEN" and check that:

(a) the valve opens within 2 s of the operation of the switch,

(b) the mechanical indicator on the valve indicates OPEN, and

(c) when a valve in tank 1, 4 or 10 is under test, the associated magnetic indicator display changes from SHUT to diagonal stripes, and then to OPEN.

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(5) Set the switch to "SHUT" and check that:

(a) the valve shuts within 2 s of the operation of the switch,

(b) the mechanical indicator on the valve indicates "SHUT", and

(c) if applicable, the magnetic indicator display changes from OPEN to diagonal stripes, and then to SHUT.

(4) Refuel the tank (Ref. 12-11-28) and check that the fuel flow rate into the tank is in accordance with Table 501.

TANK NO.	FUEL FLOW RATE AT MAX. REFUELLING PRESSURE OF 55 psig (3.795 bar	
	gal (Imp.)/min	l/min
1	53 to 59	241 to 268
4	53 to 59	241 to 268
5	132 to 148	600 to 673
6	263 to 297	1,196 to 1,350
8	216 to 244	982 to 1,109
9	277 to 313	1,259 to 1,423
10	252 to 284	1,146 to 1,291

Fuel Flow Rates
Table 501

C. Conclusion

(1) Refit the access panel removed before the test.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

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3. Leakage Test - Valve Element, including Non-return Valve

A. Prepare to Test Valve Element

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches (3CM position), are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Ensure that tank 9 contains at least 1,000 kg of fuel.

(4) Remove the appropriate valve element access panel (Ref. Removal/Installation).

(5) Open the refuel control panel access door.

B. Test Valve Element

(1) On the fuel management panel, set the appropriate tank 9 PUMP switch (LH or RH) to "ON" to pressurize the LH or RH trim system with fuel. Check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up.

(2) Check that there is no external leakage of fuel from the valve element and that no fuel is being transferred into the tank associated with the valve.

(3) On the refuel control panel, set the refuel master switch to "SET UP" and the switch for the valve to "OPEN". Check that there is no external leakage from the valve element. Set the valve switch to "SHUT".

(4) Set the tank 9 PUMP switch to "OFF".

(5) Refuel to high level (Ref. 12-11-28) the tank in which the valve is fitted.

(6) Defuel an adjoining tank (Ref. 28-25-00, Servicing).

(7) On the refuel control panel, set the switches for the valves in both of these tanks to "OPEN".

(8) Check that there is no transfer of fuel from the full tank to the empty tank over a period of 15 min.

(9) Set the switches for both valves to "SHUT".

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(10) Set the refuel master switch to "OFF-DEFUEL".

C. Conclusion

(1) Refit the access panel removed before the test.

(2) Close the refuel panel access door.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00, Servicing.

4. <u>Leakage Test - Valve Canister</u>

A. Prepare to Test Valve Canister

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Open the access door and ensure that all refuel inlet valve switches on the refuel control panel are set to SHUT.

(4) Place placards on both panels, warning that the settings of the switches must not be altered.

(5) Remove the appropriate valve element access panel (Ref. Removal/Installation).

<u>NOTE</u>: The valve element must be installed for the purpose of this test.

(6) Defuel and drain the tank containing the canister under test (Ref. 28-25-00, Servicing).

(7) Remove the appropriate tank access panel (Ref. Removal/Installation) to gain access to the canister.

B. Test Valve Canister

(1) On the fuel management panel, set the appropriate tank 9 PUMP switch (LH or RH) to "ON" to pressurize the LH or RH trim system with fuel. Check that the LOW PRESS caption is illuminated and then extinguished within 3 s as pump pressure builds up.

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WARNING: OBSERVE THE FUEL TANK SERVICING SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

(2) Enter the tank and check, over a minimum period of 5 min, that there is no fuel leakage from the pipe-to-canister and canister-to-tank connections.

(3) Set the PUMP switch to "OFF".

R (4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (5) Refit the tank access panel in accordance with 53-00-00 and 57-00-00, Removal/Installation.

CAUTION: OBSERVE THE FUEL DISTRIBUTION SAFETY PRECAUTIONS DETAILED IN 12-00-10, AIRCRAFT GROUND STABILITY.

R (6) Refuel the tank (Ref. 12-11-28) to high level and check that there is no external fuel leakage from the tank access panel joint.

NOTE: The following operations, 7, 8 and C.(1), need only be carried out if it is required to check the sealing of the canister isolation sleeve. This is not necessary if a new canister has been fitted.

R (7) Remove the valve element (Ref. Removal/Installation).

R (8) Check that the rate of fuel leakage from the canister does not exceed 7.6 cc/min.

C. Conclusion

(1) Install the valve element (Ref. Removal/Installation).

(2) Carry out a Functional and a Leakage Test of the valve element (Ref. paras.2. and 3.).

(3) Remove the placards from the fuel management panel and the refuel control panel. Close the access door.

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REFUEL CONTROL UNIT - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

Two refuel control units (RCUs) control fuel delivery to the trim transfer pipes during refuelling. Access to the units is through hinged doors in the underwing fairings below tanks 5 and 8. Each unit can be removed without draining the associated tank, but the trim transfer pipes, to which the units are connected via a tank mounting, must be drained and this requires tanks 9, 10 and 11 to be empty. Fuel system controls and indicators are on the fuel management panel (3CM position).

2. Refuel Control Unit

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-
R R Clean container, 5 gal (23 l) capacity, for fuel spillage	-

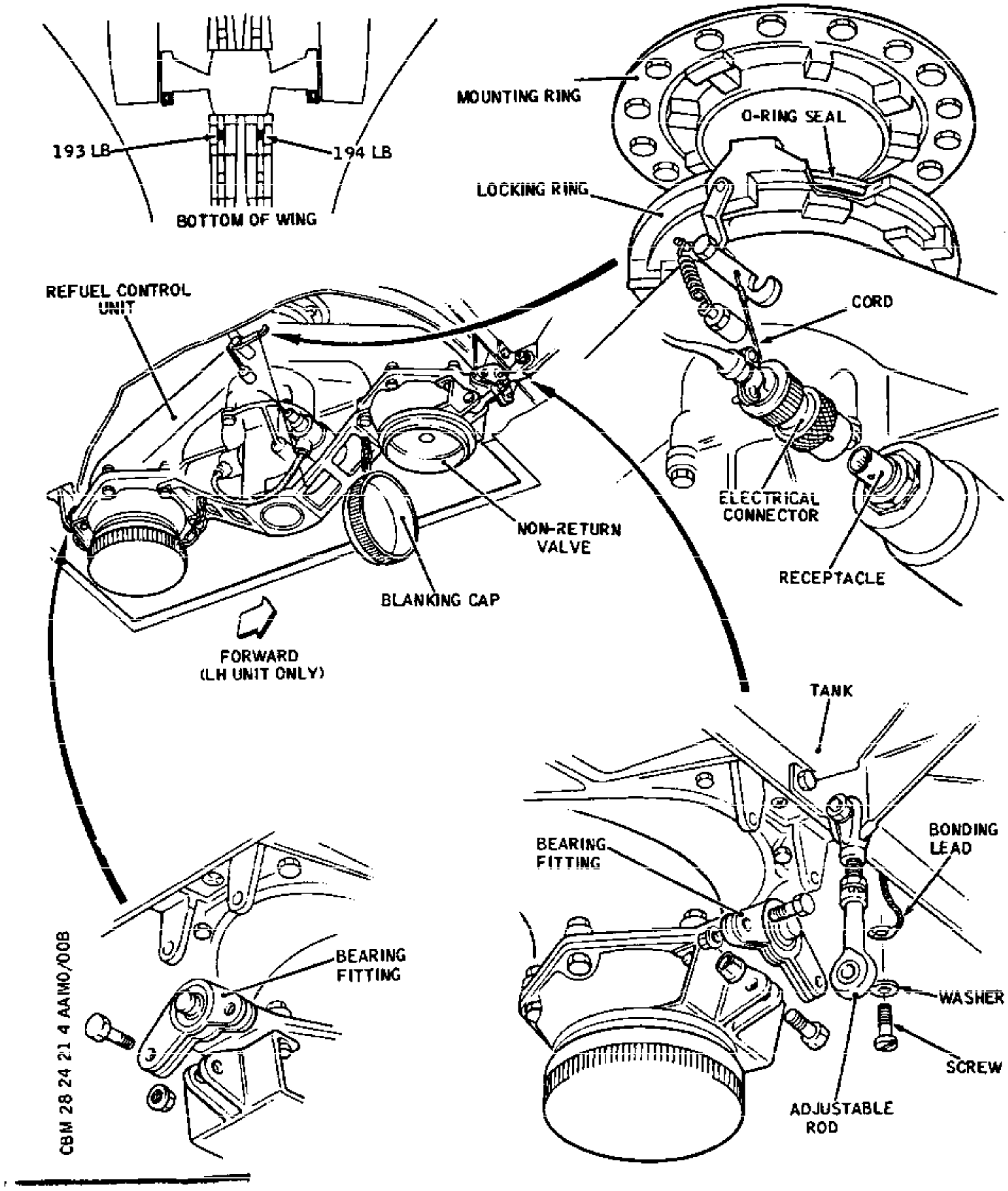
B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Defuel tanks 11, 9 and 10 in this sequence (Ref. 28-25-00, Servicing).

(3) Ensure that there is room for approximately 180 kg of fuel in tank 3, partially defuelling the tank if necessary (Ref. 28-25-00, Servicing).

(4) On the fuel management panel (3CM), drain the trim



Refuel Control Unit - Installation
Figure 401

transfer pipes as follows:-

(a) Set tank 9 LH and RH INLET VALVE switches to "OPEN" to allow air into the trim transfer pipes. Check that the associated indicators show diagonal stripes and then bar-in-line.

(b) Set the TRIM PIPE DRAIN valves switch to "OPEN" and check that the associated indicators display OPEN.

NOTE: This allows fuel to be drained into the scavenge tank and to be pumped automatically by the scavenge pump into tank 3.

(c) When the scavenge pump indicator displays OFF, set the TRIM PIPE DRAIN valves switch to "SHUT" and check that the associated indicators display SHUT.

(5) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(6) Trip the following circuit breakers and fit safety clips:-

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL SHUT-OFF & VENT VALVE IND	15-215	Q511	E19
REFUEL CONT & FAIL IND	15-215	Q513	E20
GROUND POWER REFUEL CONT & IND	25-216	Q635	B8

R Before SB 53-042A

(7) Open the RCU access door.

R After SB 53-042A For A/C 001-007,

R (7) Open the RCU access door and ensure that the
R distance piece is latched by the spring clip.

C. Remove

(1) Set the RCU control handle to the open position to allow fuel to drain past the isolating valve.

(2) Position a 5 gal (23 l) container below the RCU to collect fuel spillage.

(3) Remove the blanking caps, depress the non-return valves to drain residual fuel from the RCU, and replace the blanking caps. Remove the container.

(4) Disconnect the electrical connector from the RCU.

(5) Remove the bolt securing the adjustable rod to the RCU .

(6) Remove the screw from the bonding plate on the RCU and detach the bonding lead.

(7) Remove the two bolts securing each bearing fitting to the tank structure, noting the positions of the earthing bolts.

(8) Support the RCU, and rotate the RCU locking ring, by means of the cord, to disengage the locking ring from the mounting ring in the tank, then withdraw the RCU. Remove and discard the O-ring seal from the top of the RCU.

(9) Remove the two bearing fittings from the RCU spigots and fit suitable blanks to the RCU apertures and the tank mounting.

D. Install

<u>CAUTION</u>: BEFORE INSTALLING A REPLACEMENT RCU, ENSURE THAT THE STORAGE RUBBER SPACERS BETWEEN THE BLANKING CAPS AND NON-RETURN VALVES HAVE BEEN REMOVED.

(1) Comply with the electrical safety precautions.

(2) Remove the blanks from the tank mounting and from the RCU.

(3) Fit the two bearing fittings to the RCU spigots.

(4) Fit a new O-ring seal, lubricated in accordance

with 20-23-11, to the top of the RCU.

(5) Hold the locking ring in the rotated position, by means of the cord, and carefully fit the RCU into the neck of the mounting ring in the tank. Release the cord and check that the locking ring has secured the mounting ring.

(6) Secure each bearing fitting to the tank structure with the two bolts and nuts, ensuring that the special earthing bolt is correctly positioned. Torque-tighten to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(7) Connect the electrical bonding lead to the bonding plate on the supply coupling housing and check the bonding in accordance with 20-27-11.

(8) Secure the adjustable rod to the RCU with the bolt and nut. Torque-tighten the nut to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(9) Connect the electrical connector to the RCU, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal (Ref. para.B.(6)).

(2) Carry out a Functional Test of the RCU (Ref. Adjustment/Test).

R Before SB 53-042A

(3) Close the hinged access door in the underwing fairing.

R After SB 53-042A For A/C 001-007,

R (3) Close the hinged access door in the underwing
R fairing.

R NOTE: It is not necessary to push up the door
R before closing, as the link overcentre
R locking system is replaced by a spring
R clip latch mechanism.

REFUEL CONTROL UNIT - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises an Operational Test and a Leakage Test of the refuel control unit (RCU).

The Operational Test details the procedures for testing the control handle operation and indications, including the automatic shut-off of the fuel supply when the electrical supply to the unit fails.

Controls and indications used for the tests are on the fuel management panel (3CM) and on the refuel control panel forward of the main landing gear bay in the right-hand lower fairing.

Functional Test requirements are satisfied by the flow check detailed in 28-24-00, Adjustment/Test, paragraph 4., Refuelling Completion Time. A System Test is not applicable in this instance.

2. Operational Test

A. Prepare

(1) Ensure that the fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

R Before SB 53-042A

(3) Open the appropriate RCU access door and remove the blanking caps from both couplings on the unit.

R After SB 53-042A For A/C 001-007,

R (3) Open the appropriate RCU access door and ensure
R that the distance piece is latched by the spring
R clip. Remove the blanking caps from both
R couplings on the unit.

(4) Open the refuel control panel access door and set the refuel master switch to "REFUEL".

B. Test

(1) Push the entry non-return valves on the RCU open manually and check that they function correctly.

CAUTION: A FUEL-FILLED DASHPOT IN THE RCU RESTRICTS THE RATE OF TRAVEL OF THE ISOLATING VALVE. TO AVOID DAMAGE TO THE RCU CONTROL HANDLE AND ASSOCIATED MECHANISM THE DURATION OF MOVEMENT FROM SHUT TO OPEN AND FROM OPEN TO SHUT MUST NOT BE LESS THAN 3 s IN EACH DIRECTION.

(2) Rotate the control handle on the RCU clockwise to the open position and check that the visual indicator displays OPEN.

(3) Close the refuel control panel access door and check that the visual indicator on the RCU displays FAILED and the control handle remains in the open position.

(4) Rotate the control handle counter-clockwise to the shut position and open the refuel control panel access door. Check that the visual indicator on the RCU displays SHUT.

C. Conclusion

R Before SB 53-042A

(1) Refit the blanking caps to both couplings on the RCU and close the RCU access panel doors.

R After SB 53-042A For A/C 001-007,

R (1) Refit the blanking caps to both couplings on the
R RCU and close the RCU access panel doors.

R NOTE: It is not necessary to push up the door
R before closing, as the link overcentre
R locking system is replaced by a spring
R clip latch mechanism.

(2) Switch the refuel master switch to "OFF - DEFUEL" and close the refuel control panel access door.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test

A. Prepare

(1) Ensure that the fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

R Before SB 53-042A

(3) Open the appropriate RCU access door and remove the blanking caps from both couplings on the unit. Check that the control handle is set to the shut position and the visual indicator displays SHUT.

R After SB 53-042A For A/C 001-007,

R (3) Open the appropriate RCU access door and ensure
R that the distance piece is latched by the spring
R clip. Remove the blanking caps from both couplings
R on the unit. Check that the control handle is
R set to the shut position and the visual indicator
R displays SHUT.

(4) On the fuel management panel (3CM), allow fuel to enter the associated trim transfer pipe as follows:-

(a) Ensure that the switches for all the tank INLET VALVES, STANDBY INLET VALVES, TRANSFER VALVES, TRIM PIPE DRAIN valves and JETTISON VALVES are set to SHUT and that the associated magnetic indicators indicate accordingly.

(b) Set the appropriate LH or RH tank 9 PUMP switch to "ON" to pressurize the trim transfer pipe. Check that the associated caption is illuminated and then extinguished as the fuel pressure builds up.

B. Test

(1) Check, over a minimum period of 5 min, that there is no external leakage of fuel from the RCU and

push the entry non-return valves open, in turn, to check that there is no leakage of fuel past the isolating valve.

(2) With the entry non-return valves closed, set the RCU control handle to the open position and check, over a minimum period of 5 min, that there is no fuel leakage.

(3) Set the RCU control handle to the closed position.

C. Conclusion

(1) Set tank 9 PUMP switch to "OFF" and check that the caption is illuminated and then extinguished as the fuel pressure falls off.

(2) Set all the fuel management panel switches to their normal ground settings (Ref. 28-00-00, Servicing).

(3) Refit the blanking caps to both couplings on the RCU.

R Before SB 53-042A

(4) Close the RCU access door and the refuel control panel access door.

R After SB 53-042A For A/C 001-007,

R (4) Close the RCU access door and the refuel control
R panel access door.

R NOTE: It is not necessary to push up the RCU
R access door before closing, as the link
R overcentre locking system is replaced by a
R spring clip latch mechanism.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

REFUELLING ADAPTER - INSPECTION/CHECK

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The Carter Aircraft Adapter Wear Gauge is used for checking three different dimensions on the aircraft refuelling adapter.

2. Equipment and Materials

DESCRIPTION	PART NO.
Carter Aircraft Adapter Wear Gauge	61657-2

3. Checking Adapter Slot Width (Ref. Fig. 601)

A. Procedure

(1) Locate the gauge onto the adapter, near one lug, so that the 'Gauge Cap' and 'Centre Pin' are facing away from the adapter. The 'Adapter Groove' in the opposite face of the gauge should ride on the rim of the adapter.

NOTE: Two lines are scribed onto the gauge facing the operator to assist with the lining up of the groove with the adapter rim.
The Centre Pin should protrude outwards towards the operator.

(2) Slide the gauge around the rim towards the opposite lug until the Centre Pin falls into the slot.

(3) On a serviceable adapter, the lining up of the pin with the slot will be evident only by a slight click or indent feeling. The pin will not move significantly into the slot.

(4) With the pin located thus, check that the top surface of the centre pin protrudes from the gauge cap.

(5) Repeat sub-paragraphs (1) to (4) on the two remaining slots.

(6) If the centre pin is flush or below the gauge cap, the adapter is badly worn. THE ADAPTER MUST BE REPLACED WITHIN 50 LANDINGS.

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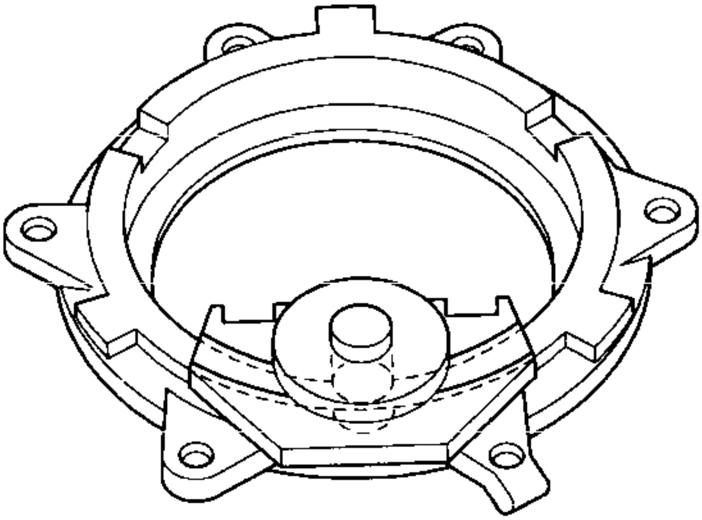

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Checking Adapter Slot Width
Figure 601

4. Checking Adapter Lug Thickness (Ref. Fig. 602)

   A. Procedure

      (1) The smaller of the two 'notches' provided on the gauge is the one used for checking adapter lug thickness.

      (2) Attempt to pass the notch across one of the lugs.

      (3) If the gauge passes completely across the lug, the adapter needs replacement. Repeat this procedure for all three lugs.

5. Checking Adapter Lug Width (Ref. Fig. 603)

   A. Procedure

      (1) Figure 603 illustrates the use of the gauge to check the width of the adapter lug.

      (2) If the gauge can be seated onto the lug, the adapter should be replaced.

      (3) Repeat the inspection on all three lugs.

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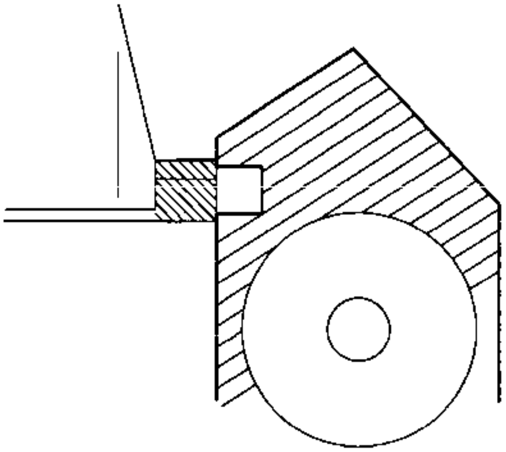
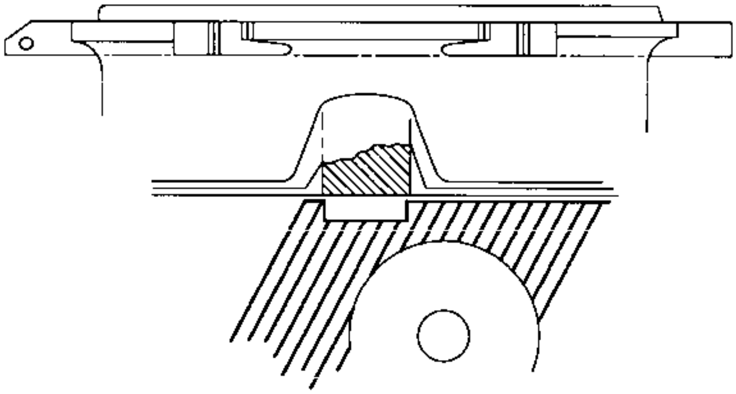


Checking Adapter Lug Thickness
Figure 602

CMB 28 24 22 6 AEM0 00



Checking Adapter Lug Width
Figure 603

REFUEL PROTECTION PRESSURE SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pressure switches are fitted, one below tank 5 and the other below tank 8. In both instances the switch is inboard of the refuel control unit.

Access to the switch is gained by removing a panel below tank 5 or a panel below tank 8. Above each of these panels there are three pressure switches. The refuel protection pressure switch is the furthest forward.

2. Refuel Protection Pressure Switch (Ref. Fig. 401)

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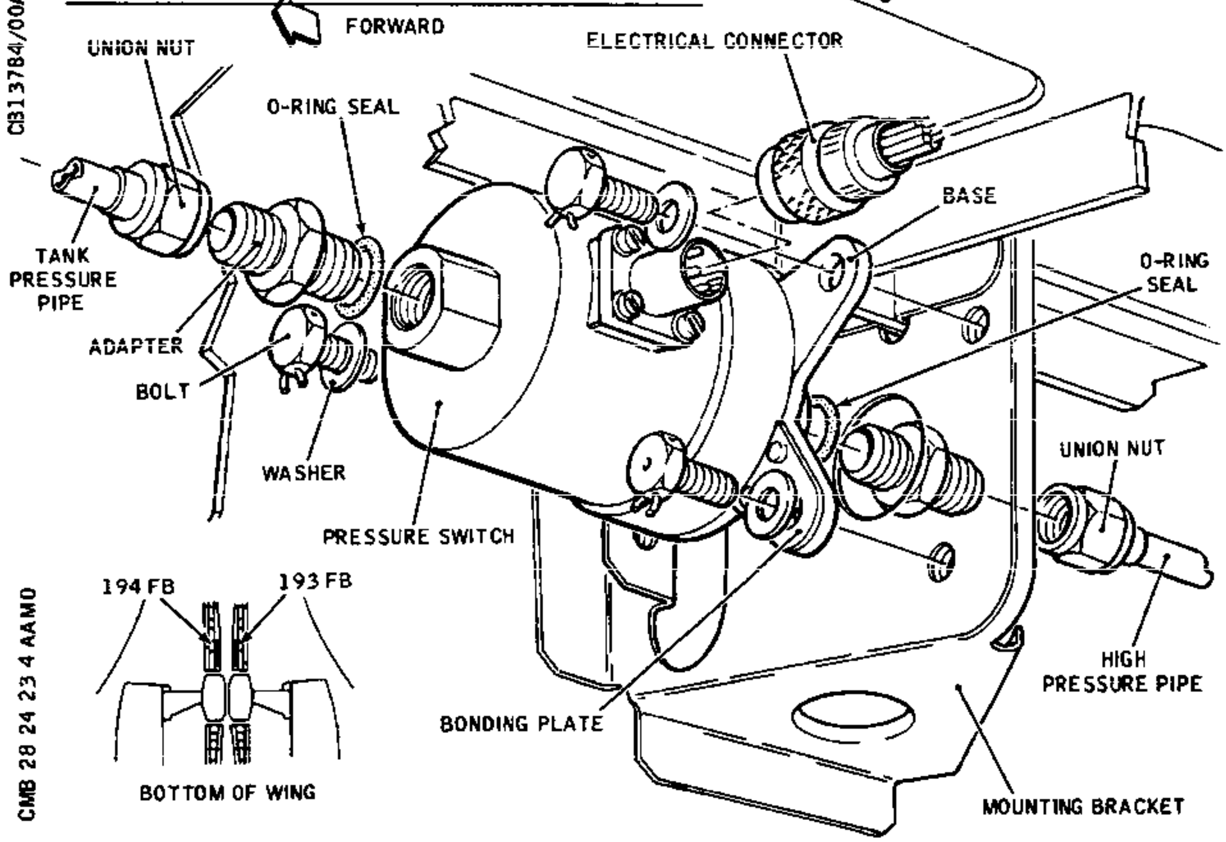


CMB 28 24 23 4 AAM0

- Refuel Protection Pressure Switch - Installation
Figure 401

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Torque spanner, 60 to 80 lbf in (0.678 to 0.904 mdaN)	-
Torque spanner, 107 to 117 lbf in (1.209 and 1.322 mdaN)	-
Receptacle, 5 gal (22.7 l), for fuel spillage	-
Bonding lead, for receptacle	-

B. Prepare

R (1) Electrically isolate the refuel circuits by tripping the following circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
REFUEL SHUT-OFF & VENT VALVES IND	15-215	Q511	E19
REFUEL CONT & FAIL IND	15-215	Q513	E20
GROUND POWER REFUEL CONT & IND	25-216	Q635	B8

R (2) Remove the appropriate access panel, 193 FB (tank 5) or 194 FB (tank 8) in the underside of the fuselage.

R (3) Place a receptacle, electrically bonded to the aircraft, beneath the pressure switch to collect

fuel spillage.

C. Remove

(1) Disconnect the electrical connector from the pressure switch.

(2) Disconnect the pressure pipes from the pressure switch and fit suitable blanks to the pipe unions immediately.

NOTE: Fuel will escape from the disconnected pipes.

(3) Remove the bolts and washers which secure the pressure switch to the mounting bracket; note the position of the bonding plate on the pressure switch attachment flange and the special bonding bolt, which has a dimpled head.

(4) Remove the adapter and O-ring seal from each end of the pressure switch. Discard the O-ring seals and fit suitable blanks to both ends of the pressure switch.

D. Install

(1) Observe the fuel and electrical safety precautions.

(2) Remove the blanks from both ends of the pressure switch. Fit new O-ring seals, lubricated in accordance with 20-23-11, to the adapters and fit the adapters to the pressure switch.

(3) Torque-tighten each adapter to between 107 and 117 lbf in (1.209 and 1.322 mdaN).

(4) Secure the pressure switch to the mounting bracket with the bolts and washers, ensuring that the special earthing bolt and bonding plate are correctly positioned.

(5) Torque-tighten each securing bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN). Wire-lock the bolts in accordance with 20-21-13.

(6) Ensure that the electrical bonding is in accordance with 20-27-11.

(7) Remove the blanks from the pressure pipe unions.

(8) Ensure that the mating surfaces of the adapters and

pipe unions are clean and undamaged.

(9) Secure the high pressure pipe to the base of the pressure switch and torque-tighten the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

(10) Secure the tank pressure pipe to the other end of the pressure switch and torque-tighten the union nut to between 60 and 80 lbf in (0.678 and 0.904 mdaN).

(11) Connect the electrical connector to the pressure switch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

R (1) Remove the safety clips and reset the circuit breakers
R tripped before removal.

R (2) Carry out a Functional and a Leakage Test of the pressure switch (Ref. Adjustment/Test).

REFUEL PROTECTION PRESSURE SWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two pressure switches, one below tank 5 and the other below tank 8, are fitted to provide protection against refuelling overpressure. Access to the switches is gained by removing panel 193 FB below tank 5 or 194 FB below tank 8. Above each of these panels there are three pressure switches. The refuel protection pressure switch is the furthest forward, inboard of the refuel control unit (RCU).

This topic comprises a Functional and a Leakage Test of the pressure switch. Operational and System Tests are not applicable.

There are two procedures for carrying out the Functional Test. The first procedure, detailed in paragraph 2., requires a fuel pressure to be applied to the pressure switch after disconnection of the high pressure sensing pipe. The second procedure, detailed in paragraph 3., requires a fuel pressure to be applied to the RCU coupling. Either procedure may be used, but the second procedure is preferable provided that the necessary ground equipment is available.

2. Functional Test (Procedure 1)

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel pressure rig, capable of producing a pressure of R 80 psig (5.520 bar)	-
Torque spanner, 40 to 65 lbf in (0.452 to 0.734 mdaN)	-
Receptacle, 5 gal (22.7 l), for fuel spillage	-
Bonding lead, for receptacle	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(3) Open the refuel control panel access door. Check that the refuel master switch is at OFF-DEFUEL.

R Before SB 53-042A

(4) Open the appropriate RCU access panel. Set the control handle on the unit to the open position and check that the visual indicator displays OPEN (Ref. 28-24-21, Adjustment/Test).

R After SB 53-042A For A/C 001-007,

R R R R R R (4) Open the appropriate RCU access panel and ensure that the distance piece is latched by the spring clip. Set the control handle to the open position and check that the visual indicator displays OPEN (Ref. 28-24-21, Adjustment/Test).

(5) Remove the appropriate panel to gain access to the pressure switch.

(6) Place a receptacle, electrically bonded to the aircraft, beneath the pressure switch to collect fuel spillage.

C. Test

NOTE: Fuel will escape from the disconnected pipe in the following operation.

(1) Disconnect the high pressure sensing pipe from the base of the pressure switch (Ref. Removal/Installation) and immediately fit a suitable blank to the pipe.

(2) Connect the fuel pressure rig to the switch in place of the disconnected pipe.

(3) Using the fuel pressure rig, slowly apply a fuel pressure to the switch and check that the RCU

shuts down when the pressure is between 59 and 64 psig (4.068 and 4.413 bar).

NOTE: When the RCU shuts down, the control handle remains at the open position and the visual indicator displays FAILED.

(4) Reduce the pressure to 54 psig (3.723 bar). Set the handle on the RCU to the shut position and then to the open position. Check that the visual indicator on the unit displays OPEN.

After SB 28-035 For A/C 002-005,

(3) Using the fuel pressure rig, slowly apply a fuel pressure to the switch and check that the RCU shuts down when the pressure is between 70 and 76 psig (4.830 and 5.244 bar).

NOTE: When the RCU shuts down, the control handle remains at the open position and the visual indicator displays FAILED.

(4) Reduce the pressure to 65 psig (4.485 bar). Set the handle on the RCU to the shut position and then to the open position. Check that the visual indicator on the unit displays OPEN.

(5) Slowly release the fuel pressure and disconnect the fuel pressure rig.

NOTE: Fuel will escape from the disconnected pipe during the following operation.

(6) Remove the blank and reconnect the high pressure sensing pipe to the base of the pressure switch. Torque-tighten the union nut to between 40 and 65 lbf in (0.452 and 0.734 mdaN).

D. Conclusion

R Before SB 53-042A

(1) Set the RCU control handle to the closed position and shut the RCU access panel.

R After SB 53-042A For A/C 001-007,

R R (1) Set the RCU control handle to the closed position and shut the RCU access panel door.

R R R R NOTE: It is not necessary to push up the door before closing, as the link overcentre locking system is replaced by a spring clip latch mechanism.

(2) Remove the bonding lead and receptacle.

(3) Carry out a Leakage Test (Ref. para.4.) of the pressure switch.

3. Functional Test (Procedure 2)

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuel pressure rig, capable of producing a pressure of 80 psig (5.520 bar)	-
Hose end unit	Avery Hardoll PN HU 2204
Suitable adapter, for hose end unit	-

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

R Before SB 53-042A

(3) Open the appropriate RCU access panel.

R After SB 53-042A For A/C 001-007,

R R (3) Open the appropriate RCU access panel and ensure that the distance piece is latched by the spring

R clip.

(4) Remove the blanking cap from one of the RCU couplings, and fit a hose end unit to the coupling.

(5) Fit a suitable adapter to the hose end unit and connect the fuel pressure rig to the adapter.

(6) Open the refuel control panel access door. Check that the refuel master switch is at OFF-DEFUEL.

(7) Check that all refuel inlet valve switches are set to SHUT and that their associated magnetic indicators display black.

(8) Set the control handle on the RCU to the open position and check that the visual indicator displays OPEN.

C. Test

(1) Using the fuel pressure rig, slowly apply fuel pressure to the RCU and check that the unit shuts down when the pressure is between 59 and 64 psig (4.068 and 4.413 bar).

NOTE: When the RCU shuts down, the control handle remains at the open position and the visual indicator displays FAILED.

(2) Check that the amber OVER PRESS caption on the refuel control panel is illuminated.

(3) Reduce the pressure to 54 psig (3.723 bar). Set the RCU control handle to the shut position and then to the open position. Check that the visual indicator on the unit displays OPEN.

After SB 28-035 For A/C 002-005,

(1) Using the fuel pressure rig, slowly apply fuel pressure to the RCU and check that the unit shuts down when the pressure is between 70 and 76 psig (4.830 and 5.244 bar).

NOTE: When the RCU shuts down, the control handle remains at the open position and the visual indicator displays FAILED.

(2) Check that the amber OVER PRESS caption on the

refuel control panel is illuminated.

(3) Reduce the pressure to 65 psig (4.485 bar). Set the RCU control handle to the shut position and then to the open position. Check that the visual indicator on the unit displays OPEN.

(4) Check that the amber OVER PRESS caption is extinguished.

(5) Slowly release the fuel pressure.

D. Conclusion

(1) Set the RCU control handle to the closed position and disconnect the fuel pressure rig.

R Before SB 53-042A

(2) Remove the hose end unit and adapter; refit the blanking cap and shut the RCU access panel.

R After SB 53-042A For A/C 001-007,

R (2) Remove the hose end unit and adapter; refit the
R blanking cap and shut the RCU access panel door.

R NOTE: It is not necessary to push up the door
R before closing, as the link overcentre
R locking system is replaced by a spring
R clip latch mechanism.

(3) Set the refuel master switch to "OFF-DEFUEL" and close the refuel control panel access door.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Remove the appropriate panel to gain access to the pressure switch.

B. Test

(1) If necessary, refuel the appropriate tank, 5 or 8 (Ref. 12-11-28).

(2) At the fuel management panel, pressurize the associated trim transfer pipe with fuel as follows:-

(a) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(b) Set the appropriate LH or RH tank PUMP switch to "ON" and check that the associated caption is illuminated and then extinguished as the fuel pressure builds up.

(3) Check, over a period of 15 min, that the switch-to-pipe joints are free from fuel leakage.

(4) Set the PUMP switch to "OFF".

C. Conclusion

(1) Refit the access panel.

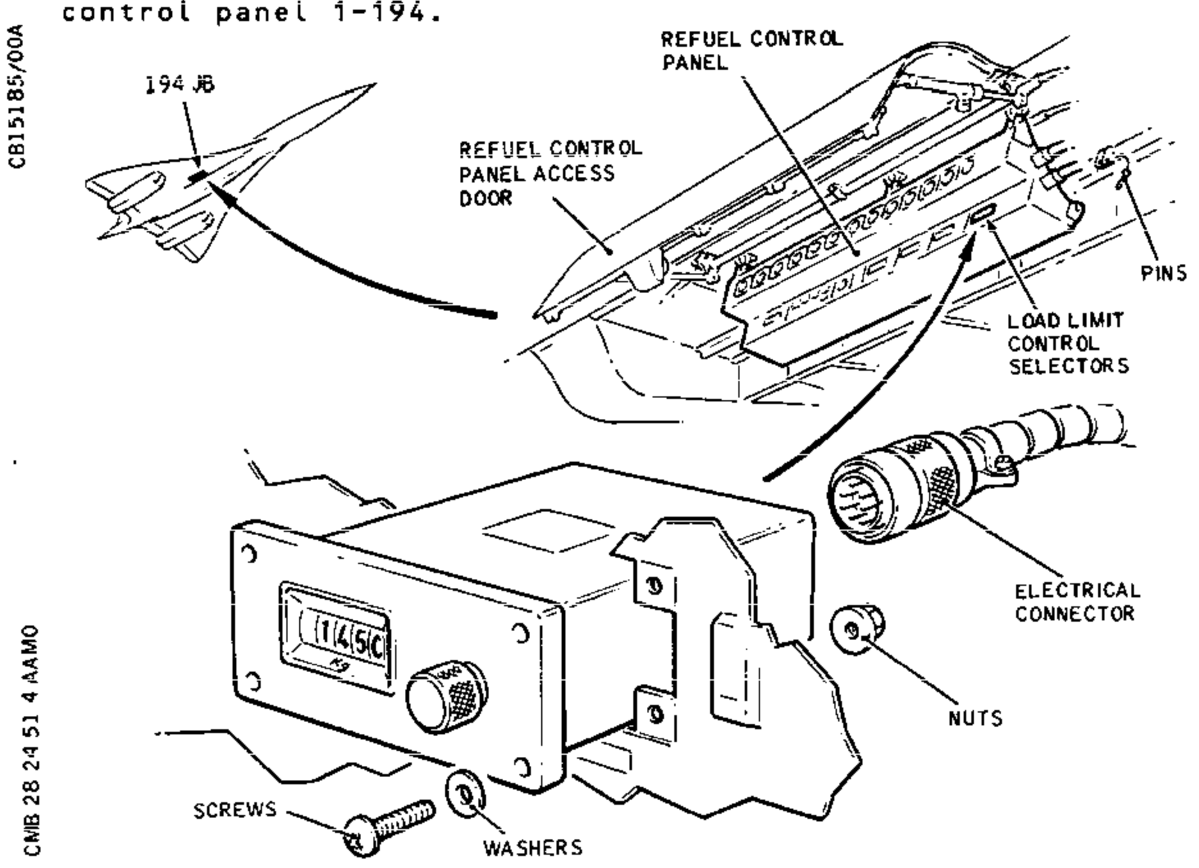
(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

LOAD LIMIT CONTROL SELECTOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

   Four load limit control selectors are fitted to the refuel control panel 1-194.



- Load Limit Control Selector - Installation
Figure 401

2. Load Limit Control Selector

   A. Prepare

      (1) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

      (2) Open the refuel control panel access door.

      (3) Remove the three quick-release pins which secure the rear face of the refuel control panel and lower the

panel.

B. Remove

(1) Disconnect the electrical connector from the selector.

(2) Remove the four screws, washers and nuts securing the selector to the panel.

(3) Withdraw the selector from the panel.

C. Install

(1) Comply with the electrical safety precautions.

(2) Install the selector in the panel aperture and secure it to the panel with the screws, washers and nuts.

(3) Connect the electrical connector to the selector, ensuring that the mating surfaces are clean and undamaged.

D. Conclusion

(1) Secure the rear face of the refuel control panel with the quick-release pins.

(2) Cancel the electrical isolation precautions (Ref. 24-00-00, Servicing) and remove the warning notices.

(3) Carry out an Operational Test of the selector (Ref. Adjustment/Test).

LOAD LIMIT CONTROL SELECTOR - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four load limit control selectors on the refuel control panel may be used to pre-set a partial fuel load in certain tanks.

This topic comprises an Operational Test; Functional and System Tests are not applicable.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Open the refuel control panel access door and set the refuel master switch to "SET UP".

(3) Select a tank, associated with the selector under test, and ensure that it contains a quantity of fuel which is less than 'high level'.

(4) Set the refuel valve switch of the selected tank to "OPEN"; check that the associated magnetic indicator display changes from black to yellow.

(5) Press the REFUEL VALVE SHUT-OFF CHECK button and check that the refuel valve magnetic indicator of the selected tank changes from yellow to black. Release the switch and check that the magnetic indicator reverts to yellow.

B. Test

(1) Pull out the setting knob of the selector and rotate the digital rollers, checking that they move freely in 10 kg steps throughout the full scale (0 - 14,500). Set the selector to a higher load figure than that in the selected tank.

(2) Release the setting knob and check that it springs back to the free-wheel position.

(3) Set the refuel master switch to "REFUEL".

(4) Set the switch near the selector to the selected tank.

(5) Decrease the setting on the selector and check that the tank refuel valve magnetic indicator display changes from yellow to black when the setting is within ±100 kg of the tank fuel quantity indicator reading.

C. Conclusion

(1) Set the switch near the selector to "OFF".

(2) Set the refuel master switch to "OFF" and close the refuel control panel access door.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

REFUEL PANEL DOOR MICROSWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

This topic contains instructions for the removal and installation of the refuel panel access door microswitch and the associated actuating lever.

The microswitch and actuating lever are bolted to a mounting bracket which is fitted to the aircraft structure directly below the refuel panel. Electrical connections to the micro-switch are made at a connector attached to one end of the microswitch body.

2. Refuel Panel Door Microswitch and Actuating Lever (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Open the refuel panel access door.

(2) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
GROUND POWER REFUEL CONT & IND	25-216	Q635	B8
REFUEL CONT & FAIL IND	15-215	Q513	E20
REFUEL SHUT-OFF & VENT VALVES IND	15-215	Q511	E19
TANKS 9, 10, 11, FQI CH 'A' & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
STBY 1 CG LIMITS & CG COMPN SUP	2-213	Q1361	A24
STBY 1 MACH LIMITS COMPN SUP	2-213	Q1362	B23
TOTAL FUEL & MAIN CG COMPN SUP	2-213	Q1363	B24
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 7, 7A & 8 FQ1 SUP	4-213	Q1355	C2
TANKS 9, 10, 11, FQ1 CH 'B' & 3CM CG IND SUP	4-213	Q1356	B1
STBY 2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B2
TANKS 9, 10, 11, REFUEL FQI & FLT COUNT SUP	4-213	Q1357	B2
STBY 2 MACH LIMITS COMPN SUP	13-216	Q1364	D3

C. Remove

(1) Disconnect the electrical cable from the microswitch.

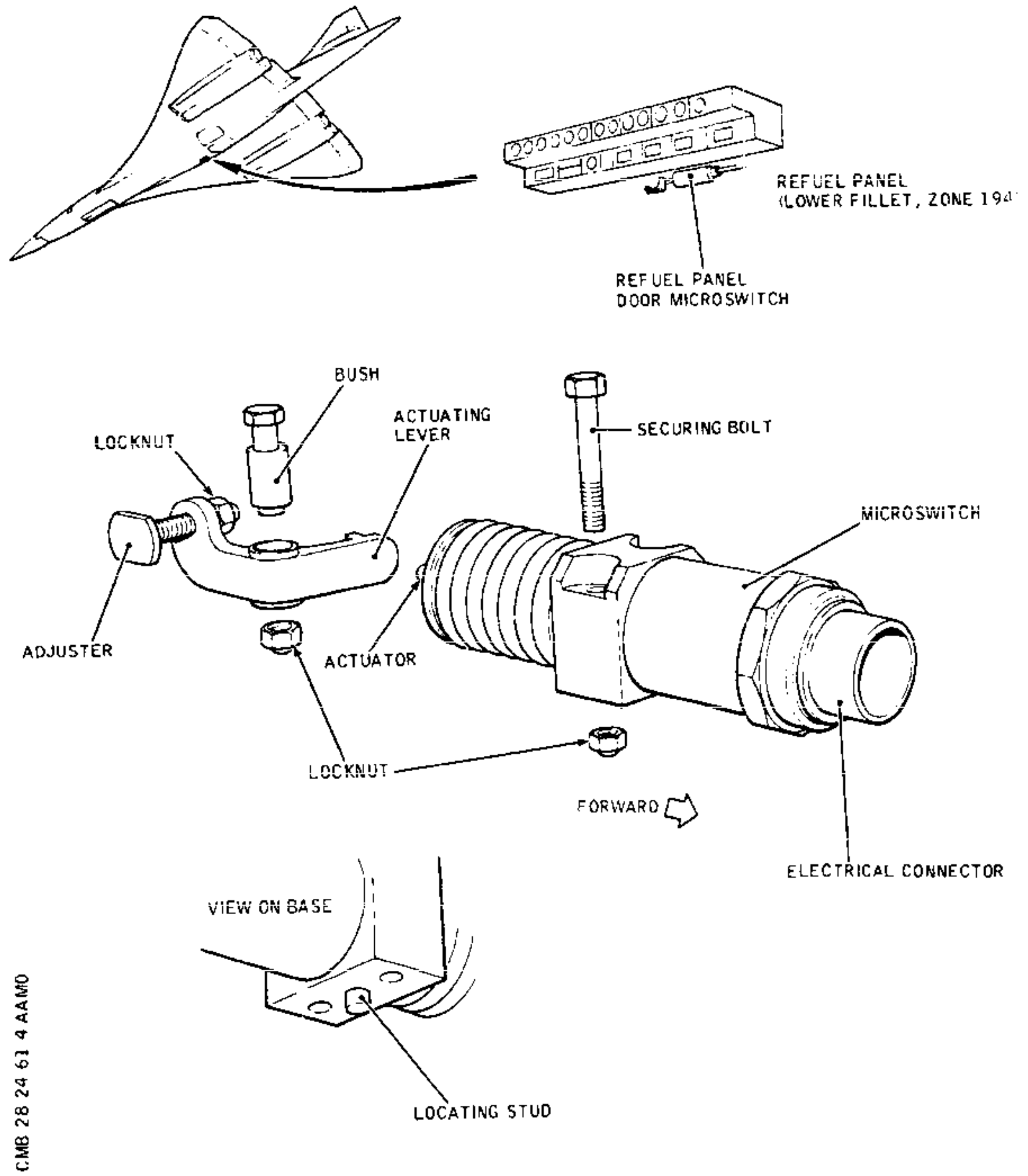
(2) Remove the bolts and locknuts securing the microswitch to the mounting bracket and remove the microswitch from its mounting.

(3) Remove the bolts and locknut securing the actuating lever to the mounting bracket and remove the lever, complete with pivot hole bush, from the mounting bracket.

D. Install

(1) Comply with the electrical safety precautions.

(2) Position the actuating lever on its mounting, so that the adjuster is facing downward and the toe of the lever is in line with the microswitch actuator, when the microswitch is fitted to its mounting.



- Refuel Panel Door Microswitch - Installation
Figure 401

(3) Fit the bush to the pivot hole in the actuating lever and secure the lever to the mounting bracket with the bolt and locknut.

(4) Position the microswitch on its mounting, with the actuator in alignment with the toe of the actuating lever and the locating stud on the bottom of the microswitch engaging the locating hole in the mounting bracket.

(5) Secure the microswitch to the mounting bracket with the bolts and locknuts.

(6) Connect the electrical connector to the microswitch, ensuring that the mating surfaces are clean and undamaged.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Carry out a Functional Test of the refuel panel door microswitch as detailed in Adjustment/Test.

(3) Close and secure the refuel panel access door.

REFUEL PANEL DOOR MICROSWITCH - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic contains instructions for an Operational Test of the door-operated microswitch and, separately, the adjustment procedures for the microswitch actuating lever.

Adjustment must be carried out after the removal/installation of the microswitch and/or any of the items mechanically associated with it, i.e., the actuating lever, the refuel control access panel and the panel hinges. Functional and System Tests are not considered necessary in this application.

The illustration (Ref. Fig. 501) details some dimensions that are not used during the adjustment procedures. These are provided to assist trouble-shooting, should an intermittent fault occur.

2. Operational Test

A. Prepare to Test

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Check that the GRD LIGHTING control switch on the oxygen panel, 20-215, is at ON.

B. Test

(1) Open the refuel panel access door and check that the refuel panel floodlamp, on the access door, is lit.

(2) Ensure that the refuel master control switch on the refuel panel is at OFF/DEFUEL. Check that the REFUEL magnetic indicator, on the upper fuel panel at the 3CM station, displays GRD.

(3) Close and secure the refuel panel access door. Check that the RE-FUEL magnetic indicator display changes from GRD to FLT and that all the fuel quantity indicators (FQIs) on the upper and lower fuel panels are energized.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Microswitch Actuating Lever Adjustment (Ref. Fig. 501)

A. Equipment and Materials

DESCRIPTION	PART NO.
Modelling clay	-
Torque spanner, 20 to 23 lbf in (0.22 to 0.26 mdaN)	-

B. Prepare to Adjust

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Check that the GRD LIGHTING control switch, on the oxygen panel 20-215, is at ON.

C. Adjust

(1) Open the refuel panel access door.

(2) Remove the protective bellows from the microswitch.

(3) Hold the actuating lever against the fixed stop and measure the clearance between the actuating lever and the thrust rod (dimension A).

NOTE: There is no minimum clearance requirement, as this is a 'jigged' installation.

(4) Position a ball of modelling clay (approximately 1 in (26 mm) dia.) close to the microswitch thrust rod.

NOTE: The clay must be pressed firmly onto the end of the microswitch, and positioned so that evidence of the travel of the actuating lever can be seen.

(5) Close and secure the refuel control panel access door.

(6) Open the access door. Check that the microswitch

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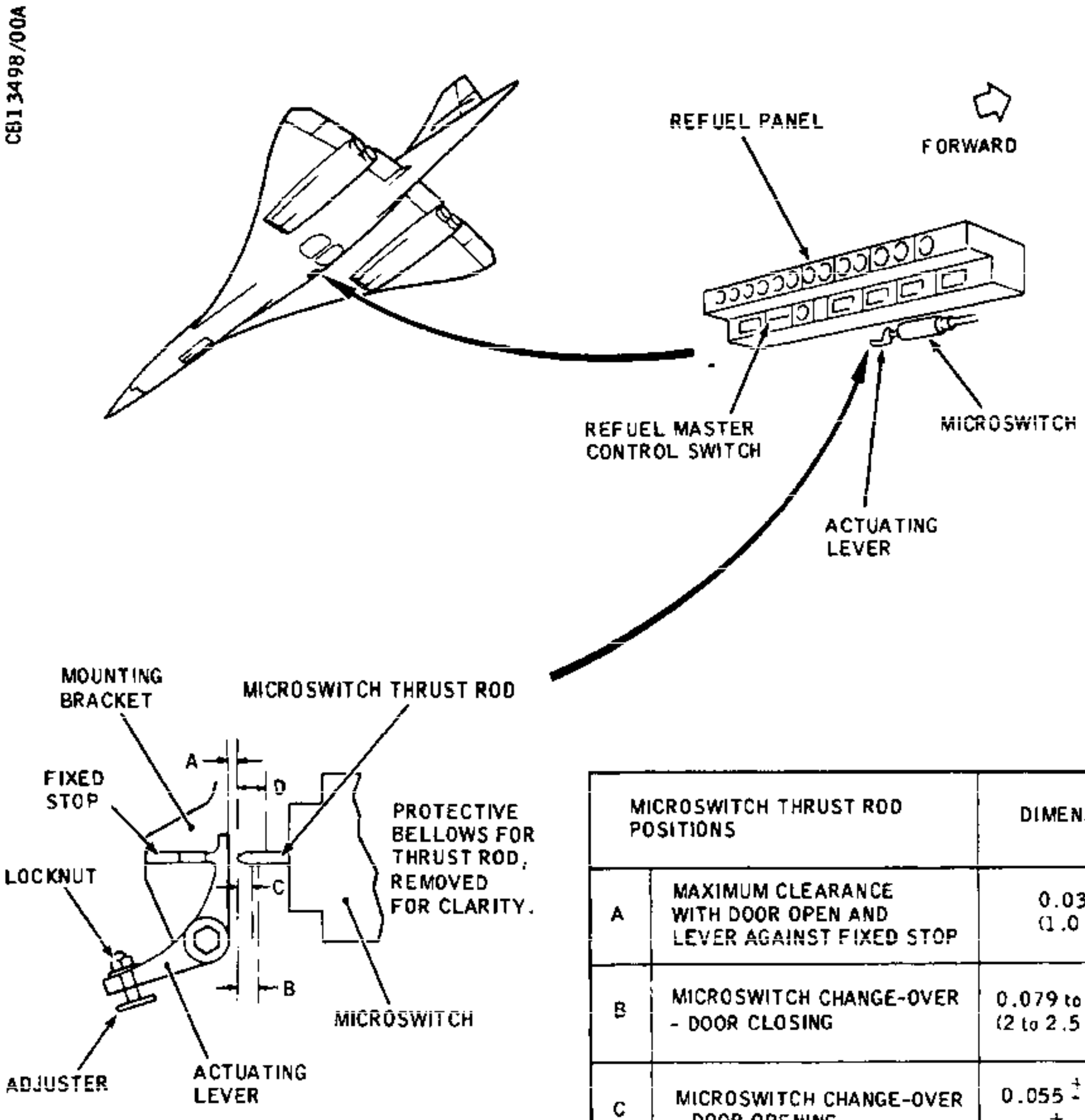

MICROSWITCH THRUST ROD POSITIONS		DIMENSION
A	MAXIMUM CLEARANCE WITH DOOR OPEN AND LEVER AGAINST FIXED STOP	0.039 in (1.0 mm)
B	MICROSWITCH CHANGE-OVER - DOOR CLOSING	0.079 to 0.098 in (2 to 2.5 mm)
C	MICROSWITCH CHANGE-OVER - DOOR OPENING	0.055 $\pm$ 0.012 in (1.4 $\pm$ 0.3 mm)
D	NOMINAL TRAVEL OF THRUST ROD	0.197 in (5.0 mm)

NOTE: 1. A ½ TURN OF ADJUSTER IS EQUAL TO 0.0156 in (0.39 mm) TRAVEL.

2. ONE COMPLETE TURN OF ADJUSTER IS EQUAL TO 0.0312 in (0.79 mm) TRAVEL

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\- Microswitch Actuating Lever - Adjustment
Figure 501

thrust rod projects 0.197(+0.0156 -0) in (5(+0.39 -0) mm) from the actuating lever mark on the modelling clay.

(7) If necessary, adjust the thrust rod projection as follows:-

CAUTION: THE ADJUSTER MUST NOT BE TURNED LESS THAN A 1/2 TURN. ENSURE THAT THE ROUNDED ENDS OF THE ADJUSTER PAD ARE ALIGNED WITH THE AIRCRAFT CENTRE LINE.

(a) Slacken the locknut and turn the adjuster as required, counter-clockwise to increase travel of the actuating lever, or clockwise to decrease travel of the actuating lever.

(b) Hold the adjuster in position and torque-tighten the locknut to between 20 and 23 lbf in (0.22 and 0.26 mdaN). Ensure that the thread of the adjuster is at least one pitch above the top of the locknut.

(8) Repeat operations (5) and (6) and, if necessary, operation (7).

D. Conclusion

(1) Remove all traces of modelling clay from the assembly.

(2) Refit the protective bellows to the microswitch.

(3) Carry out the Operational Test, detailed in paragraph 2.

TANK PRESSURE RELIEF VALVE INDICATION SELECTOR SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The tank pressure relief valve (TPRV) rotary selector switch is mounted on the refuel panel, 1-194. Access to the switch is gained by opening the refuel panel access door, 194 JB.

2. TPRV Selector Switch

A. Prepare

(1) Isolate the electrical generation and external power supplies as detailed in 24-00-00, Servicing.

(2) Open the refuel panel access door, 194 JB.

B. Remove

(1) Identify the TPRV SELECT rotary selector switch and loosen the clamp securing screws sufficiently to enable the switch unit to be withdrawn.

(2) Disconnect the electrical connector from the rear of the switch case and remove the switch; if necessary remove the panel-securing quick-release pins and hinge the panel away from the aircraft structure, for access to the rear of the panel.

C. Install

(1) Comply with the electrical safety precautions.

(2) Connect the electrical connector to the rear of the switch case; ensure that the mating surfaces are clean and undamaged.

(3) Hinge the panel back into position and secure it with the quick-release pins, if previously removed for access to the electrical connector.

(4) Slide the TPRV SELECT rotary selector switch into the panel aperture until the face is aligned correctly.

(5) Torque-tighten the clamp securing screws to between

5 and 8 lbf in (0.0565 and 0.0904 mdaN).

D. Conclusion

(1) Cancel the electrical safety precautions taken in operation 2.A.(1).

(2) Perform the relevant tests associated with the TPRV indication circuit and the refuel control panel instrument lights circuit, as detailed in 28-12-00 and 33-32-00, Adjustment/Test.

(3) Close the refuel panel access door.

END OF THIS SECTION

NEXT

DEFUEL - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

Defuelling is carried out using the pumps in the aircraft fuel tanks together with pipes and equipment in the main transfer, trim transfer, refuel and dump systems. The tank pumps, in conjunction with the collector tank jettison valves, provide for selective tank defuelling. Fuel is discharged from the aircraft through the two refuel control units mounted forward of the main landing gear bays. Electrical ground power is used for all tank pumps, except for two of the four tank 11 pumps which require hydraulic power.

To defuel the main transfer tanks (5, 5A, 6, 7, 7A and 8),
R fuel is transferred to the collector tanks; for tanks 5A and 7A, the fuel must first be transferred to tanks 5 and 7. Fuel from the collector tanks is discharged through the collector tank jettison valves, the trim transfer pipes and the refuel control units. Collector tanks 1 and 2 are emptied through
R the left-hand trim transfer pipe and RCU. Tanks 3 and 4 are emptied through the right-hand trim transfer pipe and RCU. The trim transfer tanks 9, 10 and 11 are emptied directly through the trim transfer pipes and RCUs. If complete draining of tank 11 is required, the hydraulic pumps must be used since the electric pumps will only partially drain the tank. Valves in the bottom of each tank enable any residual fuel to be drained.

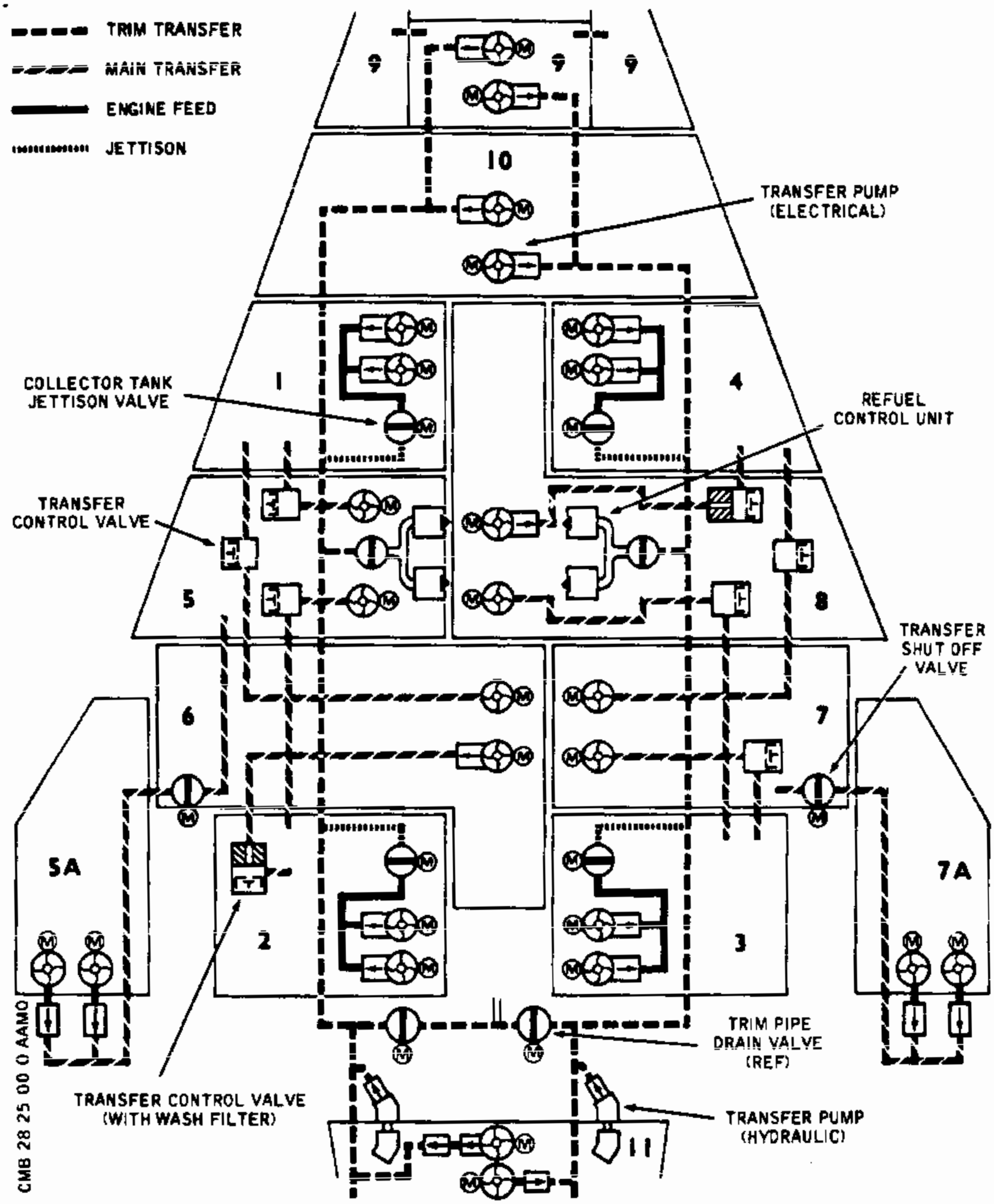
R When all the tanks are being emptied, both sides of the aircraft should be defuelled simultaneously to ensure even settling of the aircraft. There is no automatic protection against over-balancing of the aircraft resulting from fuel distribution causing rearward movement of the centre of gravity, therefore the tanks must be emptied in a predetermined sequence. It is possible, when required, for individual tanks to be defuelled by selecting the appropriate pumps and valves.
R When individual tanks are being defuelled, aircraft balance
R must be considered (Ref. 12-00-10, Aircraft Ground Stability), and internal fuel transfers made if necessary.

2. Operation (Ref. Fig. 003)

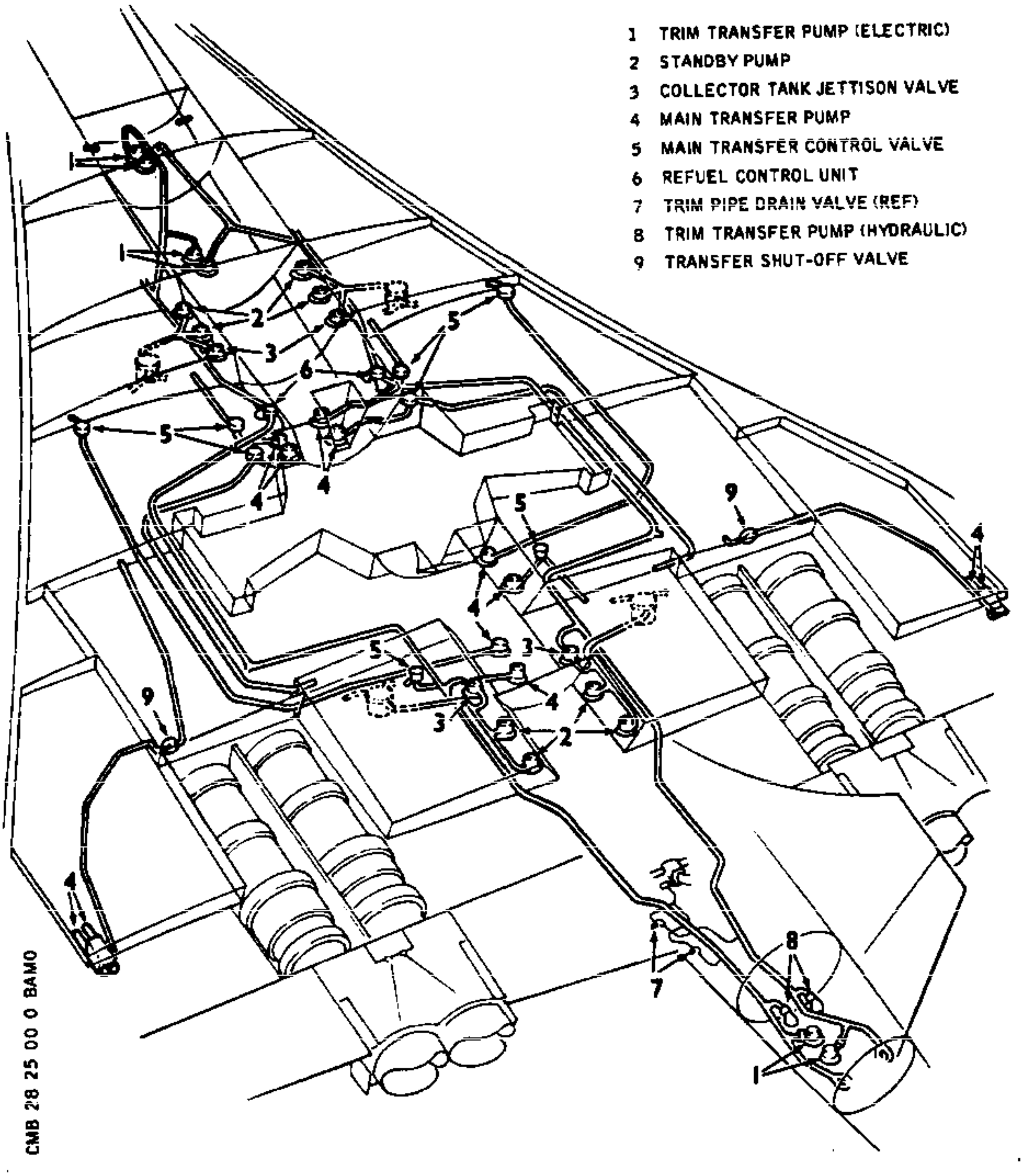
Controls and indicators used during defuelling operations are on the fuel management panel at the third crew member's station and on the refuel control units and refuel control panel forward of the main landing gear bays.

Controls and indicators on the fuel management panel are:

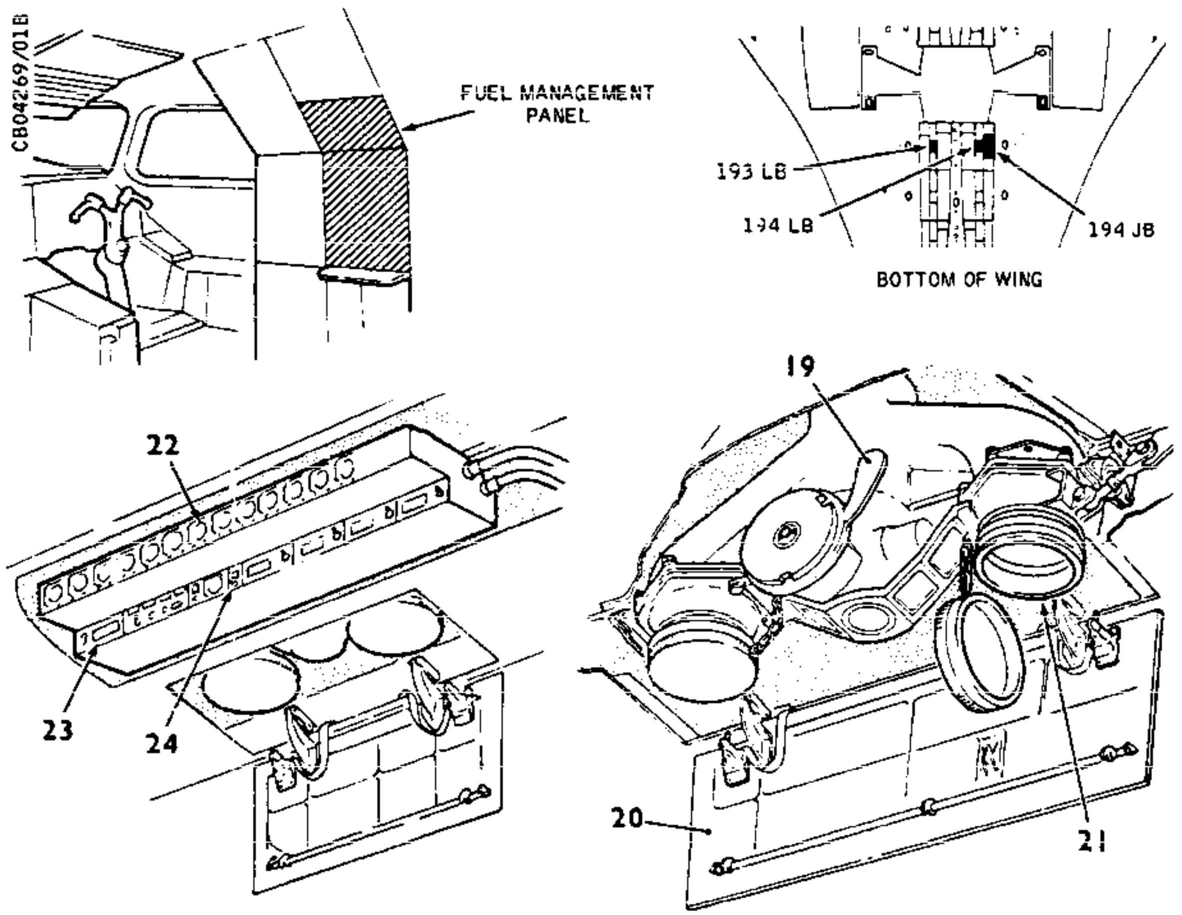
Tank level caption lights for all collector tanks (Ref.



Defuel Schematic
Figure 001



Defuel - Component Location
Figure 002



1 TANK 5A CONTROLS AND INDICATORS
2 TANK 9 CONTROLS AND INDICATORS
3 TANK 10 CONTROLS AND INDICATORS
4 COLLECTOR TANK JETTISON VALVE SWITCHES AND INDICATORS
5 TANK 7A CONTROLS AND INDICATORS
6 TANK 7 CONTROLS AND INDICATORS
7 TANK 8 CONTROLS AND INDICATORS
8 TANK 4 CONTROLS AND INDICATORS
9 TANK 3 CONTROLS AND INDICATORS
10 TANK 11 CONTROLS AND INDICATORS
11 TANK 2 CONTROLS AND INDICATORS
12 TANK 1 CONTROLS AND INDICATORS
13 TANK 6 CONTROLS AND INDICATORS
14 TANK 5 CONTROLS AND INDICATORS
15 CENTRE OF GRAVITY INDICATOR
16 TOTAL CONTENTS INDICATOR
17 ZERO FUEL WEIGHT AND CG INDICATOR
18 TOTAL FUEL REMAINING INDICATOR
19 CONTROL HANDLE
20 ACCESS DOOR
21 HOSE CONNECTION POINT
22 TANK CONTENTS INDICATORS FOR ALL TANKS
23 TOTAL CONTENTS INDICATOR
24 ORV TEST SWITCH AND INDICATOR

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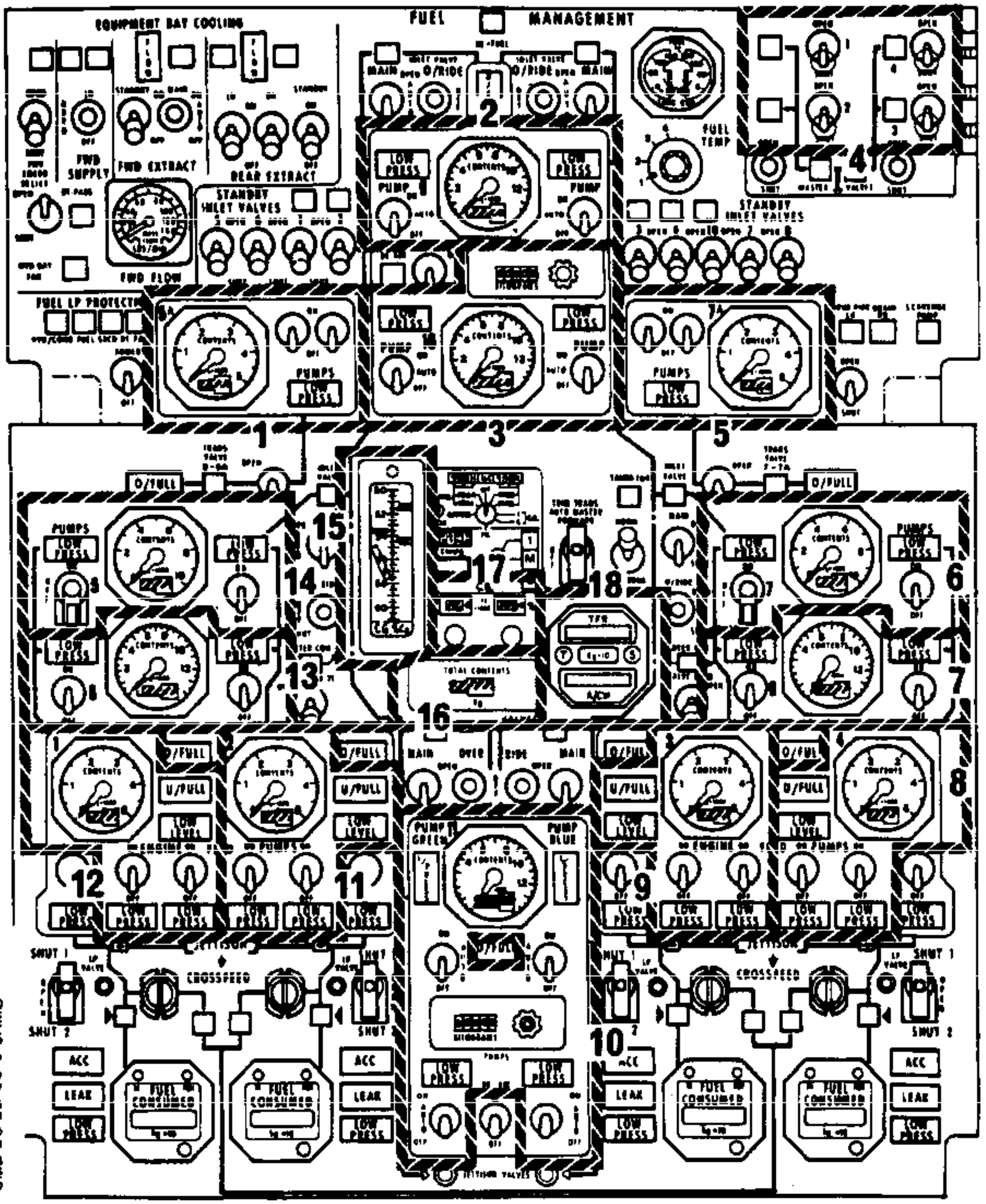
AFTER SB 53-042A -
THE RCU DOOR-OPEN LATCH LINK-OVER CENTRE LOCKING SYSTEM IS REPLACED BY A SPRING CLIP LATCH.

- Defuel Control and Indication (Sheet 1 of 2)
R Figure 003



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- Defuel Control and Indication (Sheet 2 of 2)
Figure 003

28-43-00) and low pressure caption lights for all tanks.

Tank pump switches for all tanks.

Switches and magnetic indicators for collector tank jettison valves.

Centre of gravity indicator. (To be used only if correct aircraft zero fuel weight and c.g. inputs are available).

NOTE: When the pumps are switched ON, the associated LOW
R PRESS yellow caption light is illuminated until pump working pressure is achieved. As the fuel level drops, the drop in the collector tanks 1, 2, 3 and 4
R causes the U/FULL and LOW LEVEL yellow caption lights
R to be illuminated (Ref. 28-42-00).

Fuel quantity indicators for all tanks.

Indicators and controls on the refuel control panel are:

R ORV test switch and caption light.

The only control on the refuel control units is the control handle which, when set to OPEN, mechanically opens the regulating sleeve and unlocks the isolating valve to allow fuel to pass through the unit.

Limitations, which must be observed when defuelling either the complete aircraft or individual tanks, are detailed in 28-25-00, Servicing, which also describes the defuelling
R procedure. Alternative defuelling procedures are detailed in
R 12-11-83.

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

R OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN
R 24-00-00.

R OBSERVE THE 'AIRCRAFT GROUND STABILITY' PROCEDURES
R DETAILED IN 12-00-10.

1. General

The fuel tanks are defuelled by utilizing the tank fuel pumps. Main transfer tank groups are emptied via the collector tanks, as follows:

Left-hand tanks

Tank 5A into 5; 5 and 6 into collector tanks 1 and 2, which empty via the collector tank jettison valves, the left-hand trim transfer pipe and refuel control unit (RCU).

Right-hand tanks

Tank 7A into 7; 7 and 8 into collector tanks 3 and 4, which empty via the collector tank jettison valves, the right-hand trim transfer pipe and RCU.

Trim transfer tanks 9, 10 and 11 empty via both left and right-hand trim transfer pipes and RCUs.

Both sides of the aircraft should be defuelled simultaneously, if possible, to ensure even settling of the aircraft. There is no automatic protection against the overbalancing of the aircraft in the event of fuel distribution causing the c.g. to move rearward. Therefore care must be taken during the sequence of tank emptying to ensure that the aircraft does not attain a tail-heavy condition.

Defuelling is controlled at the RCUs, which are forward of the main landing gear bays, and at the fuel management panel at the third crew member's station. Communication must be set up between the management panel and the refuel control panel.

2. Safety Regulations

A. Cleanliness

(1) All fuel must be clean. Scrupulous cleanliness

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must be observed when handling containers, defuelling hoses and allied equipment.

(2) Whenever the defueller hoses are not in use, covers must be fitted to the hose ends.

B. Fire Precautions

(1) Ensure that warning notices are prominently displayed, forbidding naked lights or smoking within 150 yd (137 m) of the defuelling point.

(2) Ensure that adequate and properly manned fire fighting equipment is in attendance.

(3) Before defuelling commences ensure that both the aircraft and the defueller are earthed and bonded to one another.

(4) During defuelling only the electrical services essential for operating the defuelling services are to be energized.

(5) Spilled fuel must be cleaned up immediately. If heavy spillage has occurred, the aircraft must be removed to another site.

(6) Do not defuel an aircraft inside a hangar unless special fire precautions are taken in accordance with local regulations.

(7) Do not defuel during an electrical storm.

3. Defuelling Limitations

(1) The following limitations must be observed during all defuelling operations:

(a) It is important to ensure that the appropriate tank defuelling sequence is followed, to prevent the aircraft becoming tail-heavy.

NOTE: Suction defuelling may be used in addition to using the aircraft pumps, but it will not significantly increase the defuelling rate.

(b) If suction defuelling is used, tanks 9, 10 and 11 will not empty unless all these tanks contain fuel.

(c) An RCU control handle must not be left at OPEN during defuelling operations, unless the defueller

cock is closed when the defuelling operation is stopped for any reason.

(d) Defuelling must be terminated by switching off the aircraft tanks transfer/engine feed pumps before closing the defueller shut-off valves.

(e) When defuelling individual tanks, the aircraft
R c.g. must be computed (Ref. 12-00-10) for the resulting fuel distribution (taking into consideration the actual zero fuel c.g. and variations which may occur while the tank is empty), or tanks may be defuelled individually subject to the following limitations:-

e1) Tanks 2, 3, 6, 7, 5A, 7A and 11 may be defuelled singly or in any combination, regardless of aircraft fuel loading.

e2) Tanks 1, 2, 3, 4, 5, 6, 7, 5A, 7A and 8 may be defuelled singly or in any combination, provided that tank 11 is empty and tanks 9 and 10 are at least 90 per cent full.

e3) Provided that the zero fuel c.g. is not further aft than 55.5 per cent Co (mean chord), tanks 9 and 10 may be defuelled either singly or together provided that tank 11 is empty and the combined contents of tanks 1, 4, 5 and 8 are at least 10,000 kg greater than the combined contents of tanks 2, 3, 6, 7, 5A and 7A.

NOTE: A c.g. of 55.5 per cent Co, or further forward, will be achieved, provided that the aircraft is complete and does not contain any payload or additional equipment aft of the main gear.

(f) Defuelling must take place only through a hose end pressure control unit (HEPCU) with a setting of at least 35 psig (2.413 bar), or, through a hose without a hose end pressure control unit fitted.

4. Complete Defuelling (Ref. Fig. 301)

WARNING: DURING ALL DEFUELLING OPERATIONS THE EXTENSION OF THE NOSE LANDING GEAR MAIN SHOCK ABSORBER UNIT MUST BE MONITORED. IF EXCESSIVE EXTENSION OCCURS, I.E.,
R THE SHOCK ABSORBER EXTENSION EXCEEDS 22.24 in
R (565 mm) (Ref. 28-00-00, Servicing - Fuel Transfer

on the Ground), DEFUELLING MUST BE STOPPED IMMEDIATELY AND FUEL REDISTRIBUTED TO CORRECT THE CONDITION.

A. Equipment and Materials

DESCRIPTION	PART NO.
Defueller, to accommodate fuel removed from aircraft	-
Drain tool, to drain residual fuel from tanks	D925374000

B. Prepare

(1) Ensure that the fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Make available ground hydraulic power using the Ground Pressurizing System as detailed in 29-23-00.

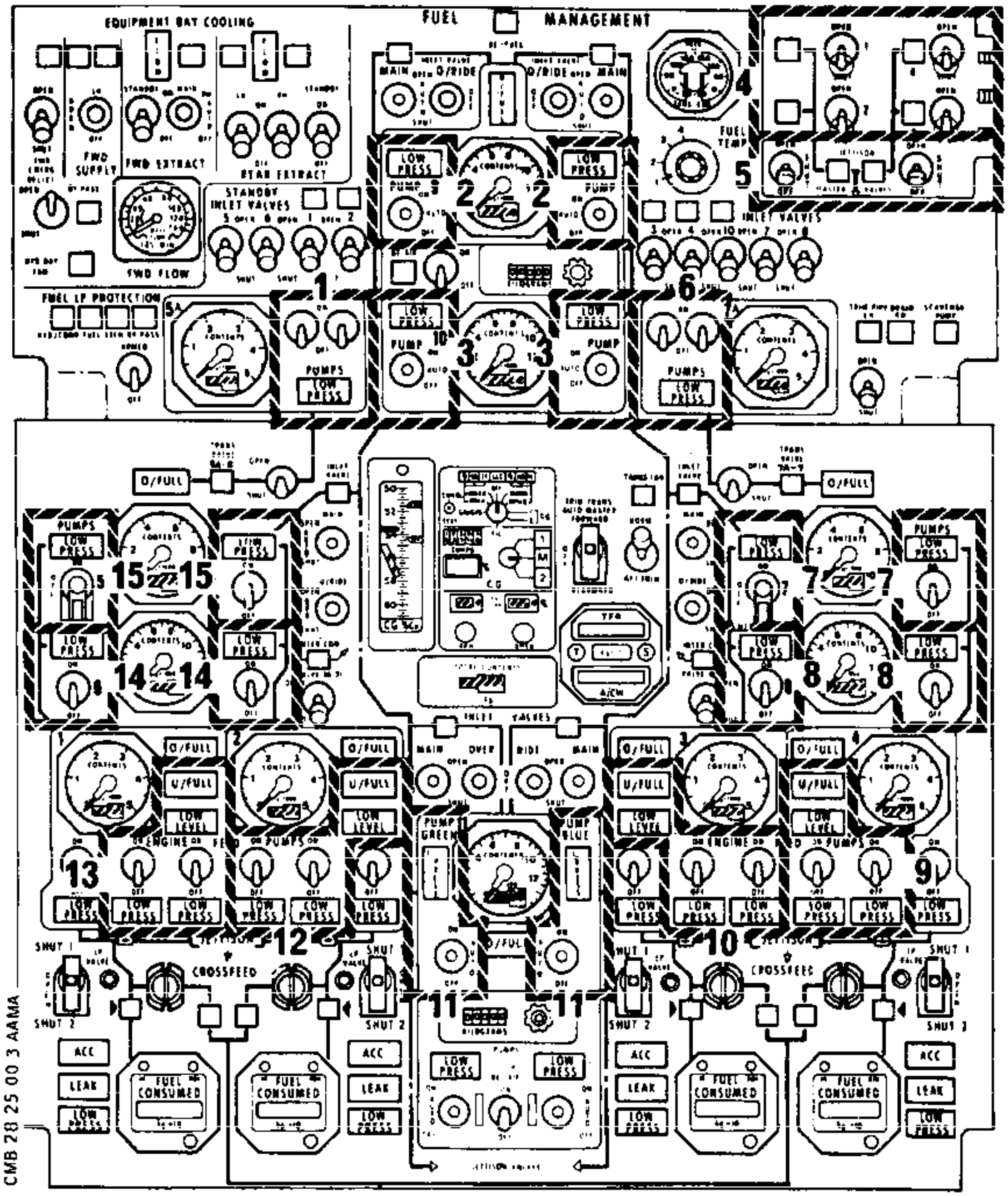
NOTE: AS the hydraulically driven pumps in tank 11 are installed lower than the electrical pumps, the hydraulically driven pumps must be used to completely defuel tank 11.

(4) At the 3CM station, panel 6-214, move the LIGHTS CTR switch to "TEST". Check that all captions on the fuel management panel are illuminated. Release the test switch.

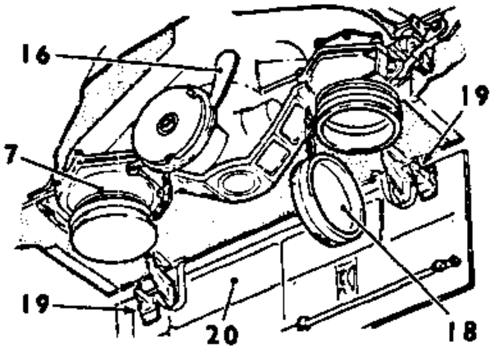
(5) Note the quantity of fuel in the tanks as indicated at the fuel management panel. Ensure that the defueller has sufficient capacity.

(6) Open the refuel control panel access door and proceed as follows:-

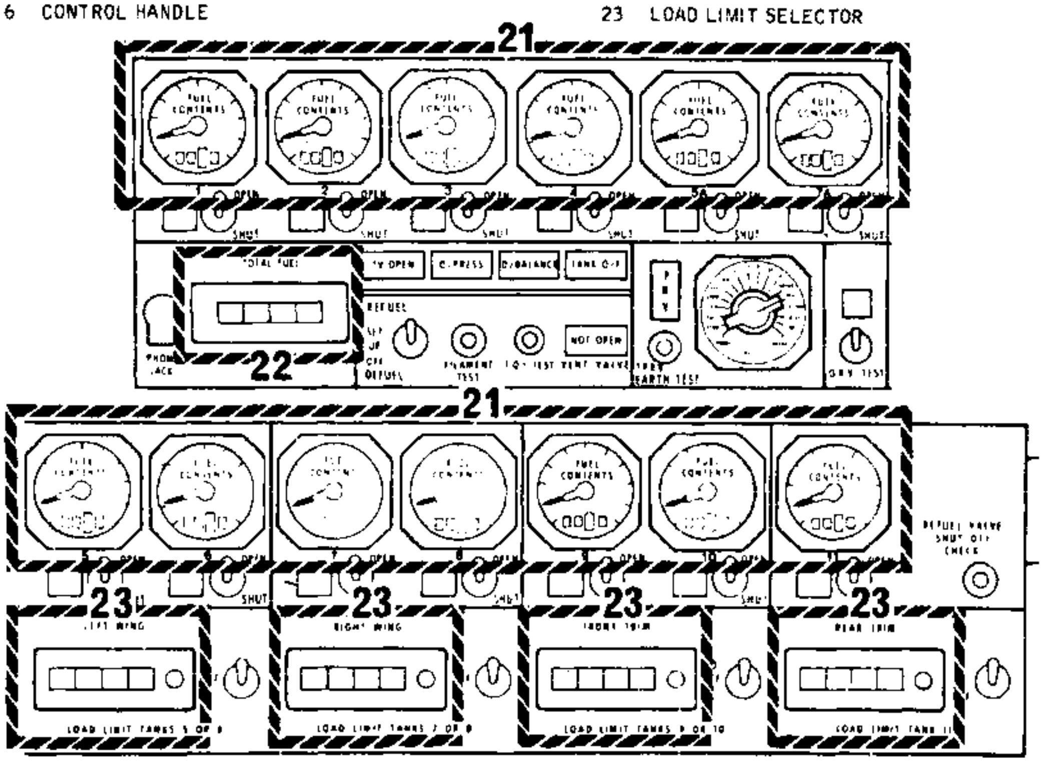
B CAUTION: PRIOR TO OPENING REFUEL CONTROL PANEL
B ACCESS DOOR, ENSURE THAT THE SCAVENGE PUMP
B IS SWITCHED "OFF". FAILURE TO DO THIS
B COULD RESULT IN FUEL SPILLAGE THROUGH
B THE OVERFLOW RELIEF VALVE.



- Defuelling Controls and Indication (Sheet 1 of 2)
Figure 301



1 TANK 5A SWITCHES AND CAPTION LIGHT
2 TANK 9 SWITCHES AND CAPTION LIGHTS
3 TANK 10 SWITCHES AND CAPTION LIGHTS
4 COLLECTOR TANK JETTISON VALVE SWITCHES AND INDICATORS
5 MASTER JETTISON VALVE SWITCHES AND INDICATORS
6 TANK 7A SWITCHES AND CAPTION LIGHT
7 TANK 7 SWITCHES AND CAPTION LIGHTS
8 TANK 8 SWITCHES AND CAPTION LIGHTS
9 TANK 4 SWITCHES AND CAPTION LIGHTS
10 TANK 3 SWITCHES AND CAPTION LIGHTS
11 TANK 11 SWITCHES AND CAPTION LIGHTS
12 TANK 2 SWITCHES AND CAPTION LIGHTS
13 TANK 1 SWITCHES AND CAPTION LIGHTS
14 TANK 6 SWITCHES AND CAPTION LIGHTS
15 TANK 5 SWITCHES AND CAPTION LIGHTS
16 CONTROL HANDLE
17 REFUELLING COUPLING
18 BLANKING CAP
19 BONDING POINTS
20 ACCESS DOOR
21 FUEL QUANTITY INDICATORS
22 TOTAL FUEL QUANTITY INDICATOR
23 LOAD LIMIT SELECTOR



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- Defuelling Controls and Indication (Sheet 2 of 2)
Figure 301

(a) Check that the refuel master switch is at OFF/ DEFUEL.

(b) Press the FILAMENT TEST switch and check that the VENT VALVE NOT OPEN caption is illuminated. Release the test switch and check that the caption is extinguished.

(c) Press the ORV TEST switch; check that its magnetic indicator displays diagonal stripes and then OPEN. Release the test switch and check that the magnetic indicator display changes to diagonal stripes and then to SHUT.

(d) Check that all refuelling valve switches are at SHUT.

(7) Ensure that there are no blanks fitted to the fuel system vent outlets.

Before SB 53-042A

(8) Open the RCU access panels.

After SB 53-042A For A/C 001-007,

(8) Open the RCU access panels and ensure that the distance piece is latched by the spring clip.

(9) Establish communication between -

(a) the fuel management panel (3CM station),

(b) the nose landing gear, and

(c) the RCUs.

C. Defuel

WARNING: ENSURE THAT THE ELECTRICAL BONDING CABLES ARE CONNECTED AND THAT BOTH THE AIRCRAFT AND DEFUELLER ARE EARTHED PRIOR TO DEFUELLING.

(1) Connect the defuelling hoses to the RCUs as follows:-

(a) Remove the blanking caps from the RCUs and the defuelling hose couplings.

(b) Connect the bonding cables on the defuelling hose couplings to the aircraft bonding connections on the access doors.

(c) Connect the defuelling hose couplings to each RCU.

NOTE: Certain types of hose coupling incorporate lever-operated shut-off valves. If this type of coupling is fitted to the defuelling hose, the shut-off valve must be opened before defuelling is commenced.

(2) Set the control handle on the RCUs to "OPEN".

(3) Defuel tank No.11 as follows:-

(a) Set the fuel PUMP GREEN and PUMP BLUE control switches and the two electrical pump control switches for tank 11 to "ON".

(b) When the fuel quantity indicator registers zero and the fuel pumps LOW PRESS captions are illuminated, set the fuel pumps switches to "OFF".

(4) Defuel tanks 2, 3, 5A, 6, 7 and 7A as follows:-

(a) Set the collector tank jettison valve switches for tanks 2 and 3 to "OPEN".

(b) Set the two ENGINE FEED standby pump control switches for both tank 2 and tank 3 to "ON".

(c) Set the main transfer pumps switches for tanks 6 to 2 and 7 to 3 to "ON".

(d) Set the TRANS VALVE 5A-5 and 7A-7 switches to "OPEN". Check that the associated magnetic indicator display changes from bar-across-line to diagonal stripes then to bar-in-line.

(e) Set the main transfer pump control switches for tanks 5 to 2, 5A and 7A to "ON".

(f) When the fuel quantity indicators for tank groups 5A and 7A, 6 and 7, 2 and 3, successively register zero and the fuel pump LOW PRESS caption is illuminated as each tank empties, proceed as follows:-

f1) Tank 5A: set the PUMPS switches to "OFF", set the TRANS VALVE 5A-5 switch to "SHUT" and the main transfer 5 to 2 PUMPS switch to "OFF".

f2) Tank 7A: set the PUMPS switches to "OFF" and the TRANS VALVE 7A-7 switch to "SHUT".

f3) Tank 6: set the main transfer pump switch for tanks 6 to 2 to "OFF".

f4) Tank 7: set the main transfer pump switch for tanks 7 to 3 to "OFF".

f5) Tanks 2 and 3: set the two ENGINE FEED standby pump switches for each tank to "OFF" and the tank 2 and 3 JETTISON switches to "SHUT".

(5) Defuel tanks 1, 4, 5 and 8 as follows:-

(a) Set the collector tank jettison valve switches for tanks 1 and 4 to "OPEN".

(b) Set the two standby pump control switches for both tanks 1 and 4 to "ON".

(c) Set the main transfer pumps switches for tanks 5 to 1 and 8 to 4 to "ON".

(d) When the fuel quantity indicators for tank groups 5 and 8, 1 and 4, successively register zero and the fuel pump LOW PRESS captions are illuminated as each tank empties, set the fuel pumps control switches to "OFF".

(e) Set the collector tank jettison valve switches for tanks 1 and 4 to "SHUT".

(6) Defuel tanks 9 and 10 as follows:-

(a) Set the pump control switches for tanks 9 and 10 to "ON".

(b) When the fuel quantity indicators for tanks 9 and 10 register zero, and the fuel pumps LOW PRESS captions are illuminated, set the fuel pumps control switches to "OFF".

D. Conclusion

(1) Switch off the ground hydraulic pressurizing system (Ref. 29-23-00).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Disconnect the defuelling hoses as follows:-

(a) Set the control handle on each RCU to "SHUT".

(b) Disconnect the hoses from the RCUs.

(c) Disconnect the bonding cables.

(d) Fit the blanking caps to the hose coupling and the RCUs.

Before SB 53-042A

(4) Close the RCU access panels and the refuel control panel access door.

After SB 53-042A For A/C 001-007,

(4) Close the RCU access panels and refuel control panel access door.

NOTE: It is not necessary to push up the RCU panel before closing, as the link overcentre locking system is replaced by a spring clip latch mechanism.

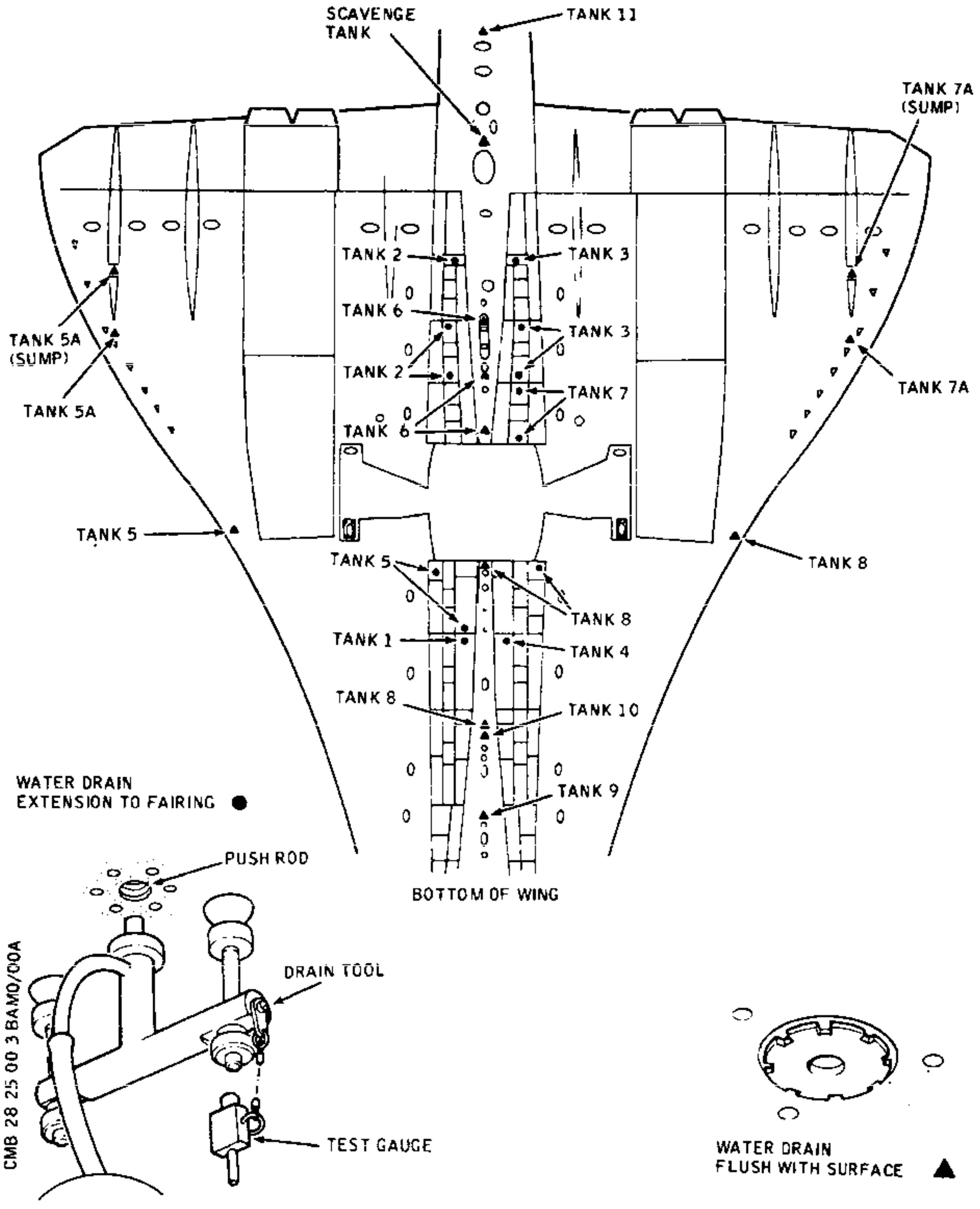
(5) Drain tanks of residual fuel (Ref. Fig. 302) as follows:-

(a) Drain the residual fuel left in the bottom of each tank after defuelling by inserting the drain tool into the appropriate water drain valve, simultaneously securing the tool to the wing undersurface, using the rubber suction cups.

(b) Depress the plunger so that fuel flows via the valve and drain tool into a suitable container.

5. Partial Defuelling

WARNING: DURING ALL DEFUELLING OPERATIONS THE EXTENSION OF



Draining Residual Fuel
Figure 302

THE NOSE LANDING GEAR MAIN SHOCK ABSORBER UNIT MUST BE MONITORED. IF EXCESSIVE EXTENSION OCCURS, I.E., THE SHOCK ABSORBER EXTENSION EXCEEDS 22.24 in (565 mm) (Ref. 28-00-00, Servicing - Fuel Transfer on the Ground), DEFUELLING MUST BE STOPPED IMMEDIATELY AND FUEL REDISTRIBUTED TO CORRECT THE CONDITION.

A. Equipment and Materials

DESCRIPTION	PART NO.
Defueller, to accommodate fuel removed from aircraft	-
Drain tool, to drain residual fuel from tanks	D925374000

B. Prepare

NOTE: Tanks may be defuelled individually, subject to the limitations detailed in paragraph 3.

(1) Prepare to defuel as detailed in paragraph 4.B.

C. Defuel

WARNING: ENSURE THAT THE ELECTRICAL BONDING CABLES ARE CONNECTED AND THAT BOTH AIRCRAFT AND DEFUELLER ARE EARTHED PRIOR TO DEFUELLING.

(1) Connect the defuelling hoses to the RCUs as follows:-

(a) Remove the blanking caps from the RCUs and the defuelling hose couplings.

(b) Connect the bonding cables on the defuelling hose couplings to the aircraft bonding connections on the access doors.

(c) Connect the defuelling hose couplings to each RCU.

NOTE: Certain types of hose couplings incorporate lever-operated shut-off valves. If this type of coupling is fitted to the defuelling hose, the shut-off valve must be opened before

defuelling is commenced.

(2) Set the RCU control handles to "OPEN".

WARNING: ENSURE THAT THE LIMITATIONS DETAILED IN PARAGRAPH 3. HAVE BEEN TAKEN INTO CONSIDERATION BEFORE SWITCHING ON TANK PUMPS.

(3) Defuel individual tanks by setting the appropriate tank pump and valve switches (Ref. Table 302) to "ON" and "OPEN" respectively.

TANK	PUMPS AND VALVES USED FOR DEFUELLING
1	Tank 1 engine standby feed pumps and tank 1 collector tank jettison valve.
2	Tank 2 engine standby feed pumps and tank 2 collector tank jettison valve.
3	Tank 3 engine standby feed pumps and tank 3 collector tank jettison valve.
4	Tank 4 engine standby feed pumps and tank 4 collector tank jettison valve.
5	Tank 5 main transfer pumps, tanks 1 and 2 engine standby feed pumps and tanks 1 and 2 collector tank jettison valves.
5A	Tank 5A main transfer pumps, tanks 5A-5 transfer valve, tank 5 main transfer pumps, tanks 1 and 2 engine standby feed pumps and tanks 1 and 2 collector tank jettison valves.
6	Tank 6 main transfer pumps, tanks 1 and 2 engine standby feed pumps and tanks 1 and 2 collector tank jettison valves.
7	Tank 7 main transfer pumps, tanks 3 and 4 engine standby feed pumps and tanks 3 and 4 collector tank jettison valves.
7A	Tank 7A main transfer pumps, tank 7A-7 transfer valve, tank 7 main transfer pumps, tanks 3 and 4 engine standby feed pumps and tanks 3 and 4 collector tank jettison valves.
8	Tank 8 main transfer pumps, tanks 3 and 4 engine standby feed pumps and tanks 3 and 4

TANK	PUMPS AND VALVES USED FOR DEFUELLING
	collector tank jettison valves.
9	Tank 9 trim transfer pumps
10	Tank 10 trim transfer pumps.
11	Tank 11 green and blue trim transfer pumps, and the two electric trim transfer pumps.

Pumps and Valves Used for Defuelling
Table 302

(4) When the fuel quantity indicator for the tank being defuelled registers zero and the appropriate fuel LOW PRESS captions are illuminated, set the fuel pump and valve switches to "OFF" and "SHUT" respectively.

D. Conclusion

(1) Switch off the ground hydraulic pressurizing system (Ref. 29-23-00).

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Disconnect the defuelling hoses as follows:-

(a) Set the control handle on each RCU to "SHUT".

(b) Disconnect the hoses from the RCUs.

(c) Disconnect the bonding cables.

(d) Fit the blanking caps to the hose coupling and to the RCUs.

Before SB 53-042A

(4) Close the RCU access panels and refuel control panel access door.

After SB 53-042A For A/C 001-007,

(4) Close the RCU access panels and refuel control panel access door.

NOTE: It is not necessary to push up the RCU panel before closing, as the link overcentre locking system is replaced by a spring clip latch mechanism.

(5) Drain defuelled tanks of residual fuel (Ref. Fig. 302) as follows:-

(a) Drain the residual fuel left in the bottom of each tank after defuelling, by inserting the drain tool into the appropriate water drain valve, simultaneously securing the tool to the wing undersurface, using the rubber suction cups.

(b) Depress the plunger so that fuel flows via the valve and drain tool into a suitable container.

6. Over-wing Defuelling

NOTE: This procedure is intended for use in circumstances that make normal defuelling impracticable.

Due to the many possible variations of fuel load and aircraft attitude, e.g., if the aircraft has all or some of its landing gear collapsed or retracted, only a general guidance to over-wing defuelling can be given. Other emergency defuelling procedures are detailed in 12-11-83.

The following procedure assumes that the refuel control units are not accessible and electrical power is not available.

A. Equipment and Materials

DESCRIPTION	PART NO.
Earthing spike, with bonding cable and clip for aircraft structure	-
Defuelling vehicle, to accommodate fuel	-
Flexible extension, for defueller hose end, 8 ft	-

DESCRIPTION	PART NO.
(2.5 m) long approximately	
Drain tool	D925374000

B. Prepare

WARNING: ENSURE THAT THE AIRCRAFT BATTERIES HAVE BEEN DISCONNECTED AND ARE POSITIVELY ISOLATED FROM THE AIRCRAFT SYSTEMS (Ref. 24-31-11).

(1) Ensure that warning notices are prominently displayed, forbidding naked lights or smoking within 150 yd (137 m) of the defuelling area.

(2) Estimate the quantity of fuel to be removed, by reference to total fuel last recorded in the tanks and subtract the total fuel since consumed, if any. Provide adequate defuelling vehicle capacity to accept this quantity.

(3) Using the earthing equipment, ensure that the aircraft and defuelling vehicle are positively earthed and bonded to each other.

(4) Areas of spilled fuel that cannot be cleaned up must be blanketed with fire-fighting foam.

(5) Refer to 28-44-00 for the location of the tank FQI probes.

(6) Estimate which probe access panel, of the tank to be defuelled, is most likely to open into tank airspace.

(7) Carefully remove the panel and probe as detailed in the appropriate subject of section 28-44-. If fuel starts to leak out from the panel, close the panel and move to another position.

C. Defuel

CAUTION: TO PREVENT INADVERTENT DAMAGE TO COMPONENTS INSIDE THE FUEL TANK, A FLEXIBLE EXTENSION MUST BE FITTED TO THE DEFUELLER HOSE END.

(1) Carefully insert the flexible hose into the fuel tank.

(2) Defuel as much fuel as is practicable from this area.

(3) Continue to remove FQI probes and defuel each area until the tanks are as empty as possible.

NOTE: It will not be possible to defuel the centre cells of tanks 9, 10, 8 and 6. Therefore, it must be noted that up to 5,000 lb (2,270 kg) of fuel may be in these tank cells. When convenient, this fuel may be drained via the water drains.

D. Conclusion

(1) Temporarily refit the FQI probes and panels until it is convenient to carry out the correct installation and adjustment procedures as detailed in the appropriate subjects of section 28-44-.

DEFUELLING - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS IN 28-00-00 AND THE ELECTRICAL SAFETY PRECAUTIONS IN 24-00-00.

1. General (Ref. Fig. 501)

A. The following procedures detail a functional test on the defuelling system, to establish that an acceptable defuelling rate is achieved. No operational test is considered necessary.

B. Control and indication for equipment in the system are on the fuel management panel, at the third crew member's station. No actions involving the refuel panel are necessary, other than opening the access door to energize the refuel control units.

2. Functional Test - Defuelling Rate

A. Equipment and Materials

DESCRIPTION	PART NO.
Fuelling unit, capable of accepting/ delivering 8,750 kg of fuel	-

B. Prepare

WARNING: ENSURE THAT THE ELECTRICAL BONDING CABLES ARE CONNECTED AND THAT BOTH THE AIRCRAFT AND REFUELLER/DEFUELLER ARE EARTHED PRIOR TO REFUELLING/DEFUELLING.

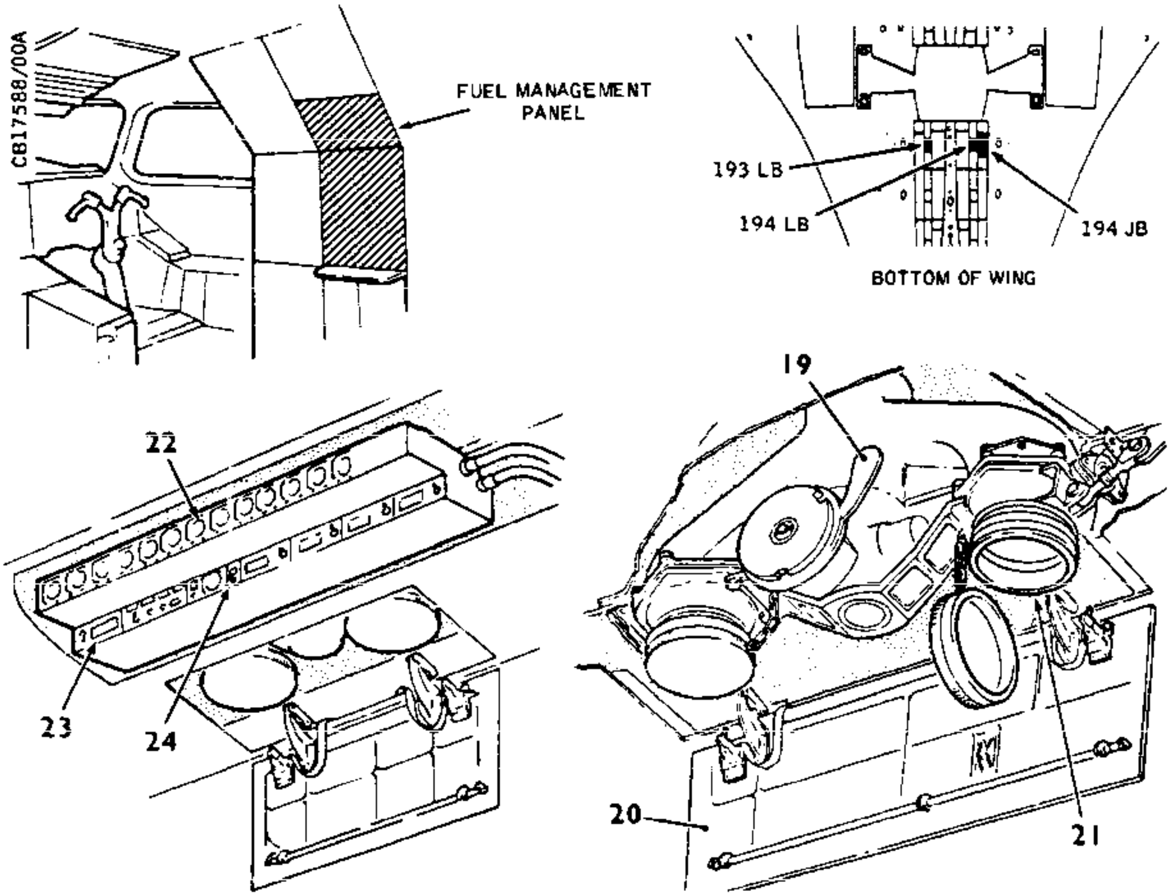
CAUTION: DEFUELLING MUST ONLY TAKE PLACE THROUGH A HOSE END PRESSURE CONTROL UNIT WITH AN AIR CHARGE PRESSURE OF AT LEAST 35 PSIG OR THROUGH A HOSE WITHOUT A HOSE END PRESSURE CONTROL UNIT.

(1) Make available electrical ground power (Ref. 24-41-00).

(2) On the fuel management panel:

(a) Check that the JETTISON MASTER VALVES switches are "SHUT".

(b) Note the quantity of fuel required to fill



1 TANK 5A CONTROLS AND INDICATORS
2 TANK 9 CONTROLS AND INDICATORS
3 TANK 10 CONTROLS AND INDICATORS
4 COLLECTOR TANK JETTISON VALVE SWITCHES AND INDICATORS
5 TANK 7A CONTROLS AND INDICATORS
6 TANK 7 CONTROLS AND INDICATORS
7 TANK 8 CONTROLS AND INDICATORS
8 TANK 4 CONTROLS AND INDICATORS
9 TANK 3 CONTROLS AND INDICATORS
10 TANK 11 CONTROLS AND INDICATORS
11 TANK 2 CONTROLS AND INDICATORS
12 TANK 1 CONTROLS AND INDICATORS
13 TANK 6 CONTROLS AND INDICATORS
14 TANK 5 CONTROLS AND INDICATORS
15 CENTRE OF GRAVITY INDICATOR
16 TOTAL CONTENTS INDICATOR
17 ZERO FUEL WEIGHT AND CG INDICATOR
18 TOTAL FUEL REMAINING INDICATOR
19 CONTROL HANDLE
20 ACCESS DOOR
21 HOSE CONNECTION POINT
22 TANK CONTENTS INDICATORS FOR ALL TANKS
23 TOTAL CONTENTS INDICATOR
24 ORV TEST SWITCH AND INDICATOR

AFTER SB 53-042A-
THE RCU DOOR-OPEN LATCH LINK-OVER CENTRE LOCKING SYSTEM IS REPLACED BY A SPRING CLIP LATCH.

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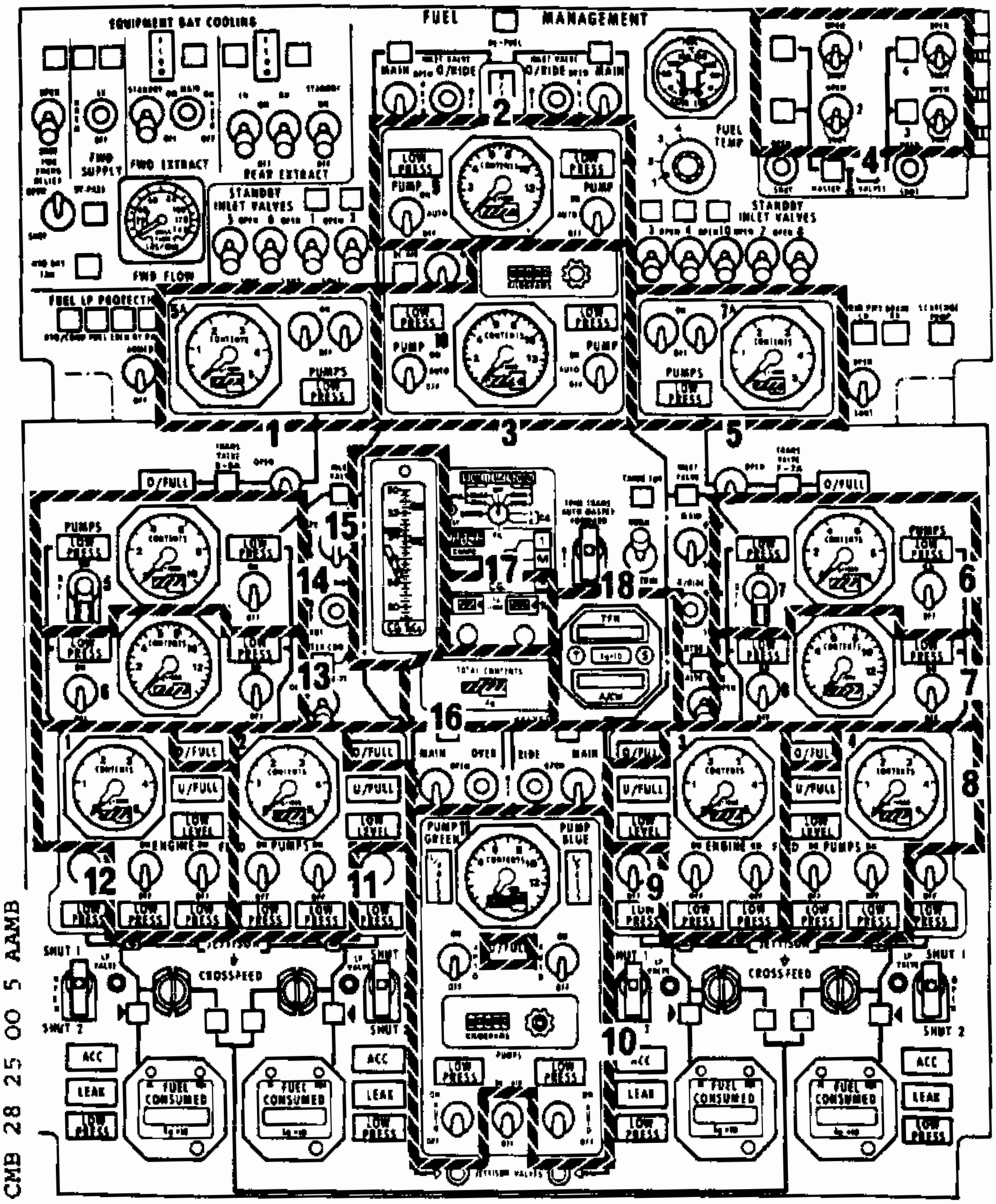
- Defuel - Controls and Indication (Sheet 1 of 2)

R Figure 501



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- Defuel - Controls and Indication (Sheet 2 of 2)
Figure 501

collector tanks 2 and 3, on the appropriate fuel quantity indicators.

R **ON A/C 001-006,

B CAUTION: PRIOR TO OPENING REFUEL CONTROL PANEL ACCESS
B DOOR, ENSURE THAT THE SCAVENGE PUMP IS SWITCHED
B "OFF". FAILURE TO DO THIS COULD RESULT IN FUEL
B SPILLAGE THROUGH THE OVERFLOW RELIEF VALVE.

(3) Open the fuel panel access door, to energize the refuel control units (RCU's).

Before SB 53-042A

(4) Open the RCU access panels.

After SB 53-042A For A/C 001-007,

(4) Open the RCU access panels and ensure that the distance piece is latched by the spring clip.

(5) Connect the fuelling hoses to the RCU's:

(a) Remove the blanking caps from the RCU's and the fuelling hose couplings.

(b) Connect the fuelling hose couplings to each RCU.

(c) Connect the bonding cables on the fuelling hose couplings to the aircraft bonding connections on the access doors.

NOTE: Certain types of hose couplings incorporate lever-operated shut-off valves. If this type of coupling is fitted to the hose the shut-off valve must be opened before refuelling/defuelling is started.

(6) Set the control handles on the RCU's to "OPEN".

(7) Fill collector tanks 2 and 3 (Ref. 28-24-00) and note contents.

(8) Set all switches to ground settings, in preparation for defuelling check.

C. Test

WARNINGS: ENSURE THAT ALL DEFUELLING LIMITATIONS (REF. 28-25-00) HAVE BEEN OBSERVED BEFORE SWITCHING ON TANK PUMPS.

DURING DEFUELLING THE EXTENSION OF THE NOSE LANDING GEAR MAIN SHOCK ABSORBER UNIT MUST BE MONITORED. IF EXCESSIVE EXTENSION OCCURS, DEFUELLING MUST BE STOPPED IMMEDIATELY AND FUEL REDISTRIBUTED TO CORRECT THE CONDITION.

(1) Defuel collector tanks 2 and 3 sufficiently to ensure that the test requirements are satisfied:

(a) Set the collector tank jettison valve switches for tanks 2 and 3 to "OPEN".

(b) Set the two standby pump control switches for both tanks 2 and 3 to "ON" and note the defuelling rate from each tank.

NOTE: The rate of flow for each tank should be approximately 170 gal/min (Imp) (618 kg/min) at zero pressure at the fuelling hose.

The fuelling vehicle pumps may be run to obtain a zero fuel pressure reading in the fuelling hose.

(2) Watch all fuel quantity indicators to ensure that no fuel is entering other tanks.

(3) Set the two standby pump control switches for both tanks 2 and 3 to "OFF", at completion of test.

(4) Set the collector tank jettison valve switches for tanks 2 and 3 to "SHUT".

(5) Switch off and disconnect electrical ground power (Ref. 24-41-00).

(6) Disconnect the fuelling hoses:

(a) Set the control handle on each RCU to "SHUT".

(b) Disconnect the hoses from the RCU's.

(c) Disconnect the bonding cables.

(d) Fit the blanking caps to the hose couplings and to the RCU's.

Before SB 53-042A

(7) Close the RCU access panels and the refuel panel access door.

After SB 53-042A For A/C 001-007,

(7) Close the RCU access panels and the refuel panel access door.

NOTE: It is not necessary to push up the RCU panels before closing, as the link over-centre locking system is replaced by a spring clip latch mechanism.

R

DEFUELLING - APPROVED REPAIRS

1. General

NOTE: When manufacturing new pipes, L.56 is an approved alternative for AG.3 material.

DUMP SYSTEM - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

The dump (jettison) system uses the tank pumps to pump fuel into the trim transfer pipes which are connected to jettison pipes in the tail cone, via two master jettison valves; these valves are opened to dump or jettison fuel overboard from an outlet in the rear of the tail cone.

Four collector tank jettison valves, one in each of tanks 1, 2, 3 and 4, connect the associated tank to the trim transfer pipe. The standby engine feed pumps are used to pump fuel from the collector tanks into the trim transfer pipes.

Fuel is jettisoned from the trim tanks (9, 10 and 11) by using the appropriate trim transfer pumps (Ref. 28-23-00, Description and Operation) and opening the master jettison valves.

Fuel is jettisoned from the collector tanks by using the standby engine feed pumps and opening the collector tank jettison valves and the master jettison valves.

Fuel is jettisoned from the main transfer tanks (5, 5A, 6, 7, 7A and 8) by transferring fuel into the collector tanks (Ref. 28-22-00, Description and Operation), operating the standby engine feed pumps, and opening the collector tank jettison valves and the master jettison valves.

Controls and indicators for the valves and pumps in the jettison system are on the fuel management panel at the third crew member's station.

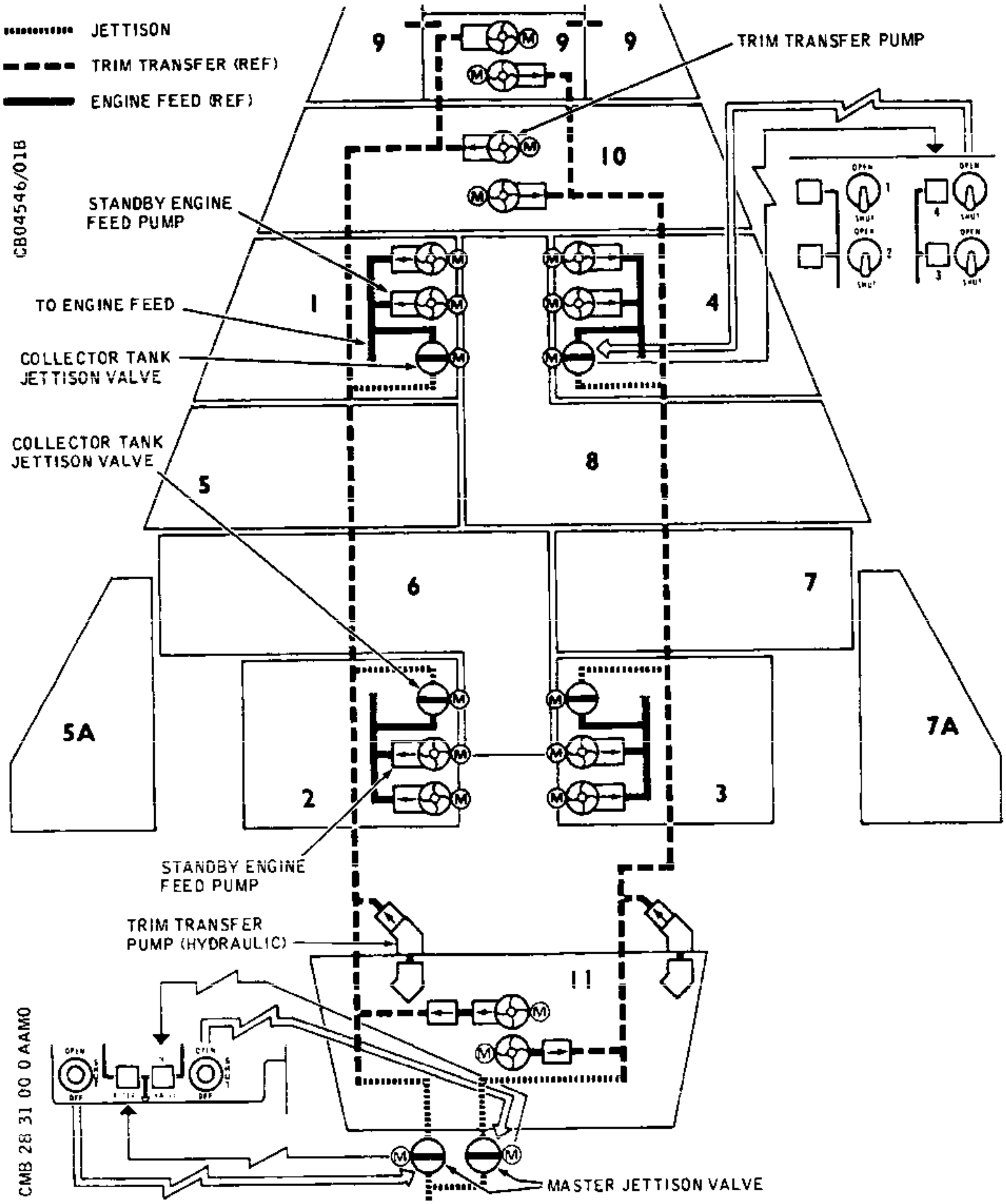
2. Collector Tank Jettison Valve (Ref. Fig. 003)

Four of these valves are fitted, one in each collector tank. The valve, which is primarily controlled from a switch on the fuel management panel, opens to connect the collector tank to the trim transfer pipe via the standby engine feed pumps in the tank.

R The valve element is similar to the refuel inlet valves (2 in)
R which are fitted with non-return valves (Ref. 28-24-00,
R Description and Operation). A balking pin on the valve
R body ensures installation of the correct valve element.

The valve is mounted on the base of the collector tank and it is fitted inside a canister which allows removal of the valve element without draining the tank or disturbing the fuel lines.

The valve element is accessible by removing a panel in the



Jettison System - Schematic
Figure 001

R

R EFFECTIVITY: ALL

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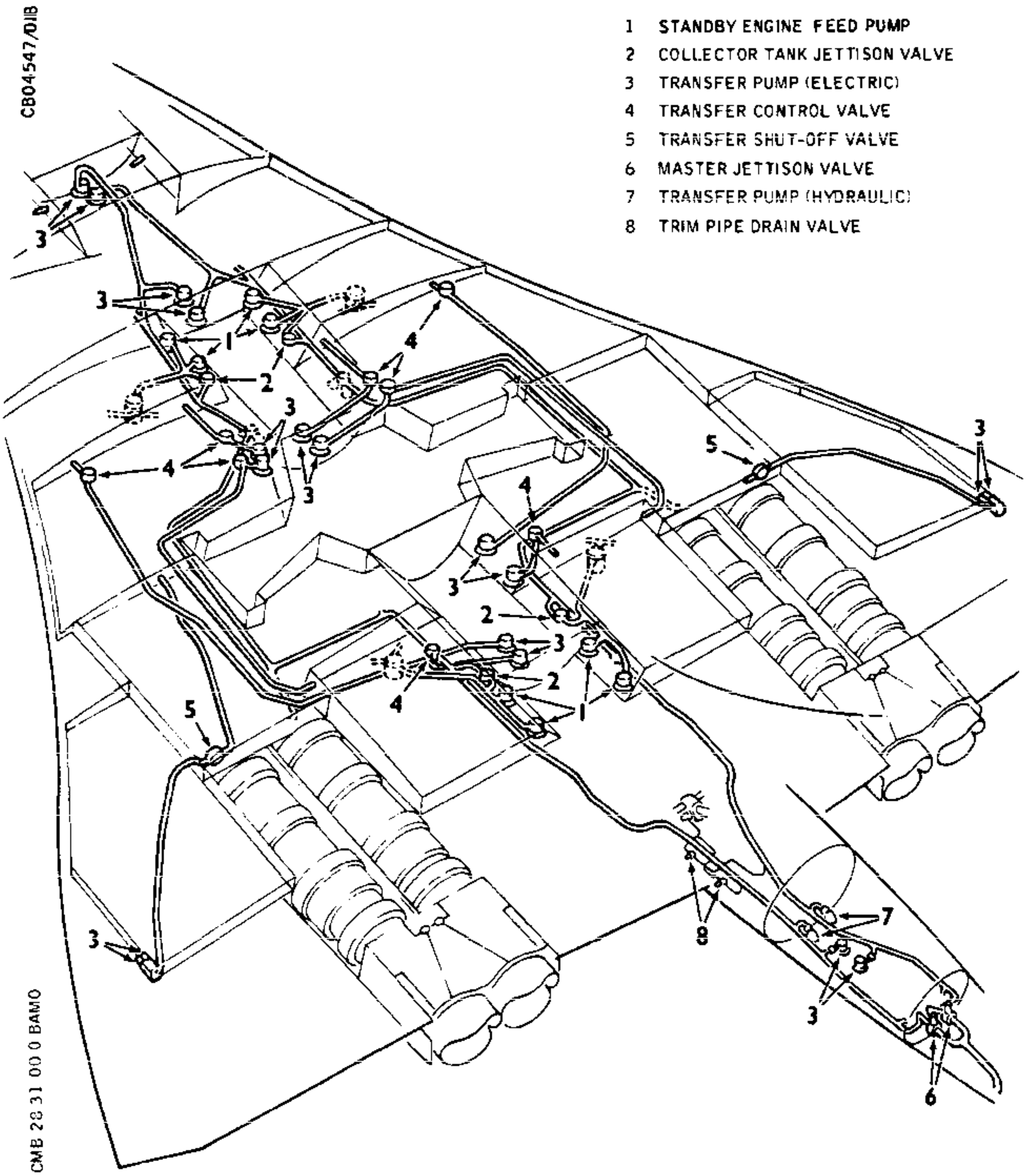
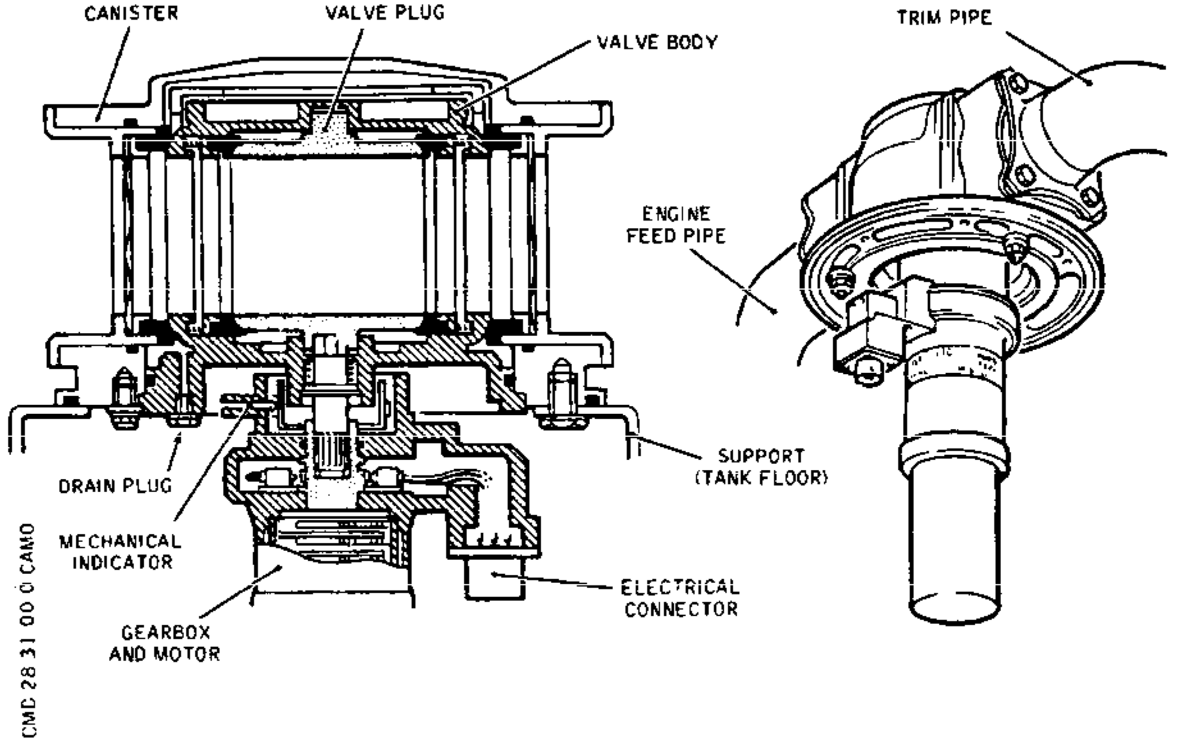


- Jettison System - Component Location
R Figure 002



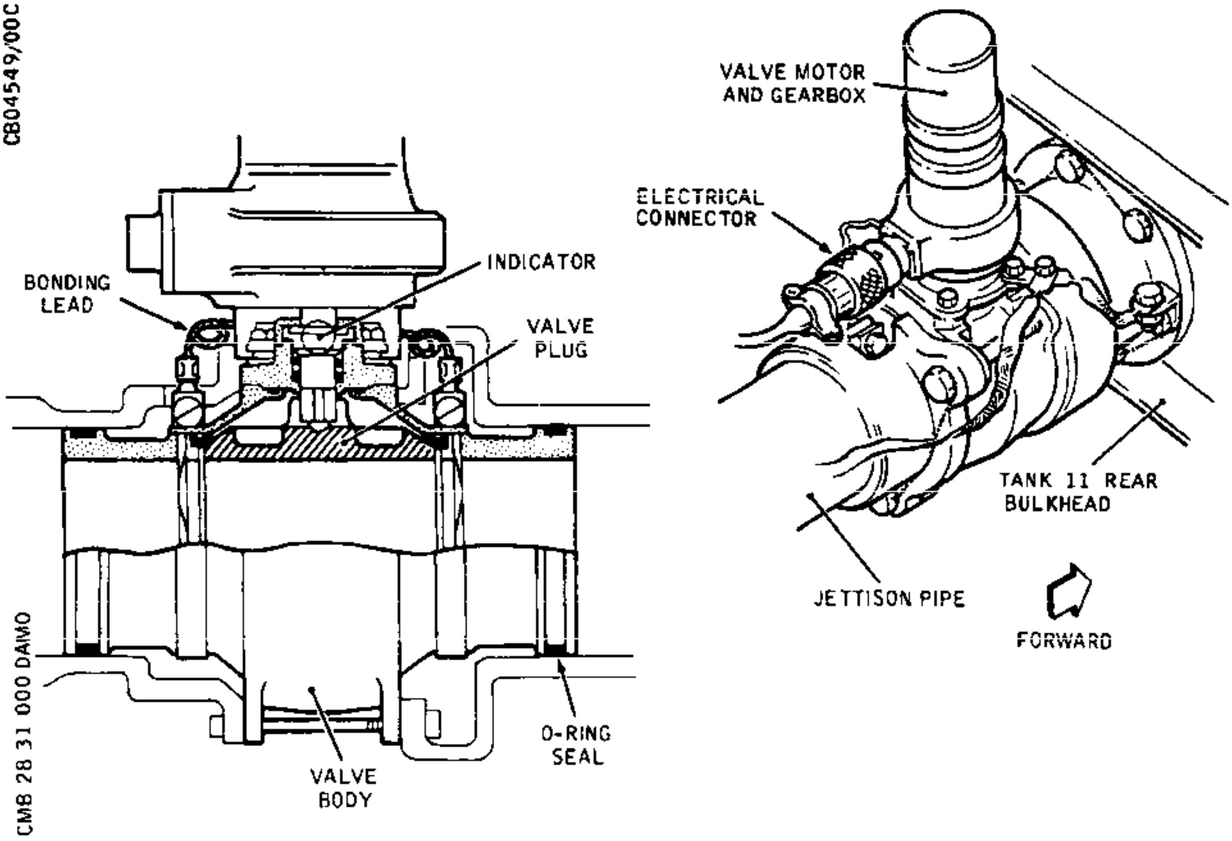
Collector Tank Jettison Valve
Figure 003

underwing fairing. The valve element body houses a rotary two-position valve plug which is driven by a detachable electric motor. The output shaft of the motor is connected, through reduction gearing, to the valve spindle.

The motor has an electro-mechanical brake, an overload clutch and overrun stops; cam-operated limit switches are fitted to control motor operation and to actuate a magnetic indicator on the fuel management panel.

When the valve is selected open, a 28 V d.c. supply is applied through one of the limit switches to release the brake and operate the motor. The motor output shaft rotates until the limit switches change over to cut off the d.c. supply and apply the spring-loaded brake. The valve plug has now rotated one quarter-turn to open the valve bore for full fuel flow.
A 'pop-out' type mechanical indicator appears at OPEN or SHUT markings on the motor mounting cover, to indicate the valve position.

3. Master Jettison Valve (Ref. Fig. 004)



Master Jettison Valve
Figure 004

Two of these valves are mounted side by side on the rear face of the tank 11 rear bulkhead. Access to the valves is gained via the tail wheel doors in the tail cone.

The valves, each controlled from an associated switch on the fuel management panel, are identified as LH and RH. Each valve opens to connect its associated trim transfer pipe to the jettison pipe outlet.

The valve is in-line mounted and consists of a body, housing a motorized two-position spherical valve plug which is rotated by a geared 28 V d.c. motor.

The motor has an electro-mechanical brake, an overload clutch and an overrun stop. Cam-operated switches control motor operation and actuate a magnetic indicator on the fuel management panel.

When the valve is selected open, a 28 V d.c. supply is applied through one of the limit switches to release the brake and operate the motor. The motor output shaft rotates until the limit switches change over to cut off the d.c. supply and apply

the spring-loaded brake. The valve plug has now rotated one quarter-turn to open the valve bore for full fuel flow.

A pointer shows a letter O or S at an aperture in the mounting cover of the motor to indicate the valve open or shut position.

4. Valve Control Relay

There are four valve control relays, one for each collector tank jettison valve. Each relay controls the supply to the associated valve motor. The relays for Nos.1 and 2 collector tank jettison valves are located in the LH fuel relay box (panel 15-123), and the relays for Nos.3 and 4 are located in the RH fuel relay box (panel 18-123).

5. Interlock Relay

There are two interlock relays. One controls the supply to the valve control relays for Nos.1 and 2 collector tank jettison valves and is located in the LH fuel relay box (panel 15-123), the other controls the supply to the valve control relays for Nos.3 and 4 collector tank jettison valves and is located in the RH fuel relay box (panel 18-123).

6. Operation

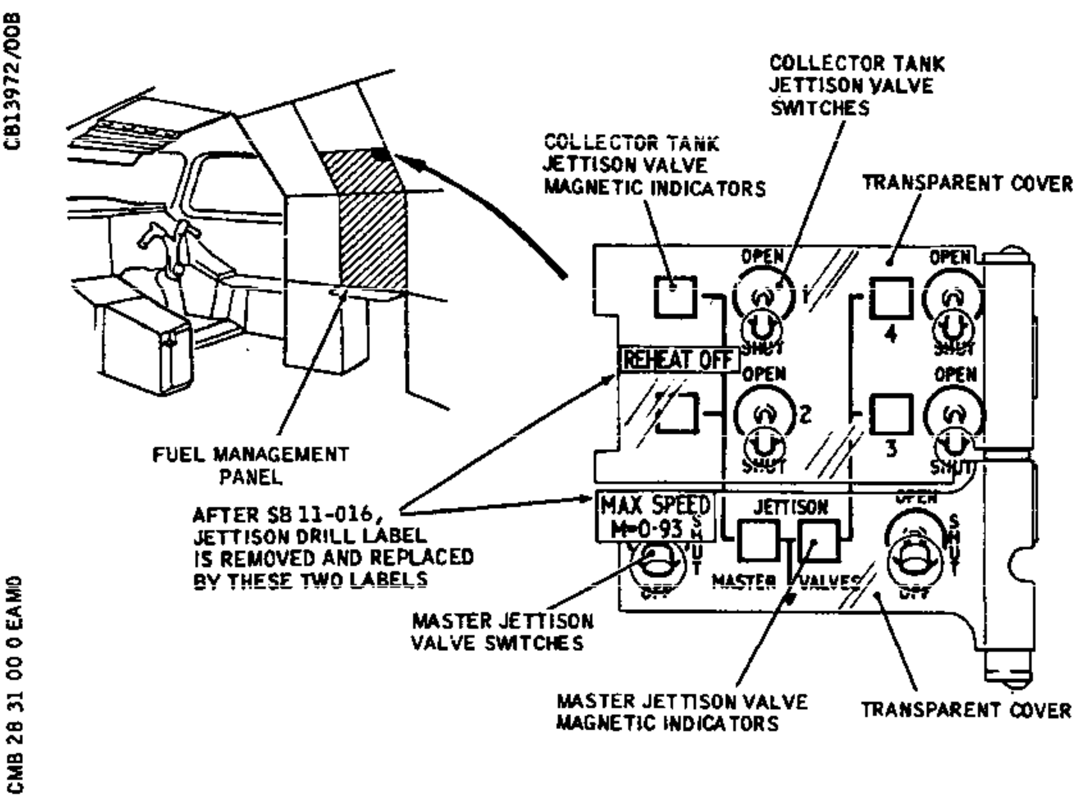
A. Control and Indication (Ref. Fig. 005)

The jettison system control switches and indicators are grouped in flow-line form on the top RH corner of the fuel management panel. The switches are guarded by a hinged transparent cover to prevent inadvertent operation. The cover is divided into two parts, the upper part guarding the collector tank jettison valve switches, and the lower part guarding the master jettison valve control switches. This arrangement allows the cover over the master jettison valve control switches to remain closed except for test purposes and actual fuel jettison.

Each of the four collector tank jettison valves is controlled by a separate, two-position, OPEN - SHUT switch.

The LH and RH master jettison valves are each controlled by a separate, three-position, OPEN - SHUT - OFF, 'locked toggle' switch.

Valve position is shown by a magnetic indicator next to each switch. Each indicator displays a white line on a black background either across or in-line with the flow line on the panel when its valve is shut or open respectively. The indicator displays diagonal stripes when the valve is in transit or when electrical power to the valve is off.



R - Jettison System - Controls and Indicators
Figure 005

The master jettison valve control switch is locked in the OFF position only. When the switch is set from OFF to SHUT, or vice versa, the toggle must be pulled out before it can be moved.
The switch may be operated from the OPEN to the OFF position without dwelling in the SHUT position. When the switch is set to OFF, the valve motor will continue to run until the valve is shut (Ref. Fig. 006).

B. Functional Description (Ref. Fig. 006)

The collector tank jettison valves can be used independently to transfer fuel from the appropriate collector tank to the trim transfer system. Assuming the valve to be shut, when the collector tank jettison valve control switch is set to OPEN the valve control relay is energized via contacts of the de-energized interlock relay and 28 V d.c. is applied, via the valve control relay, to the 'open' coils of the valve motor.

The valve opens and the limit switches change over, the

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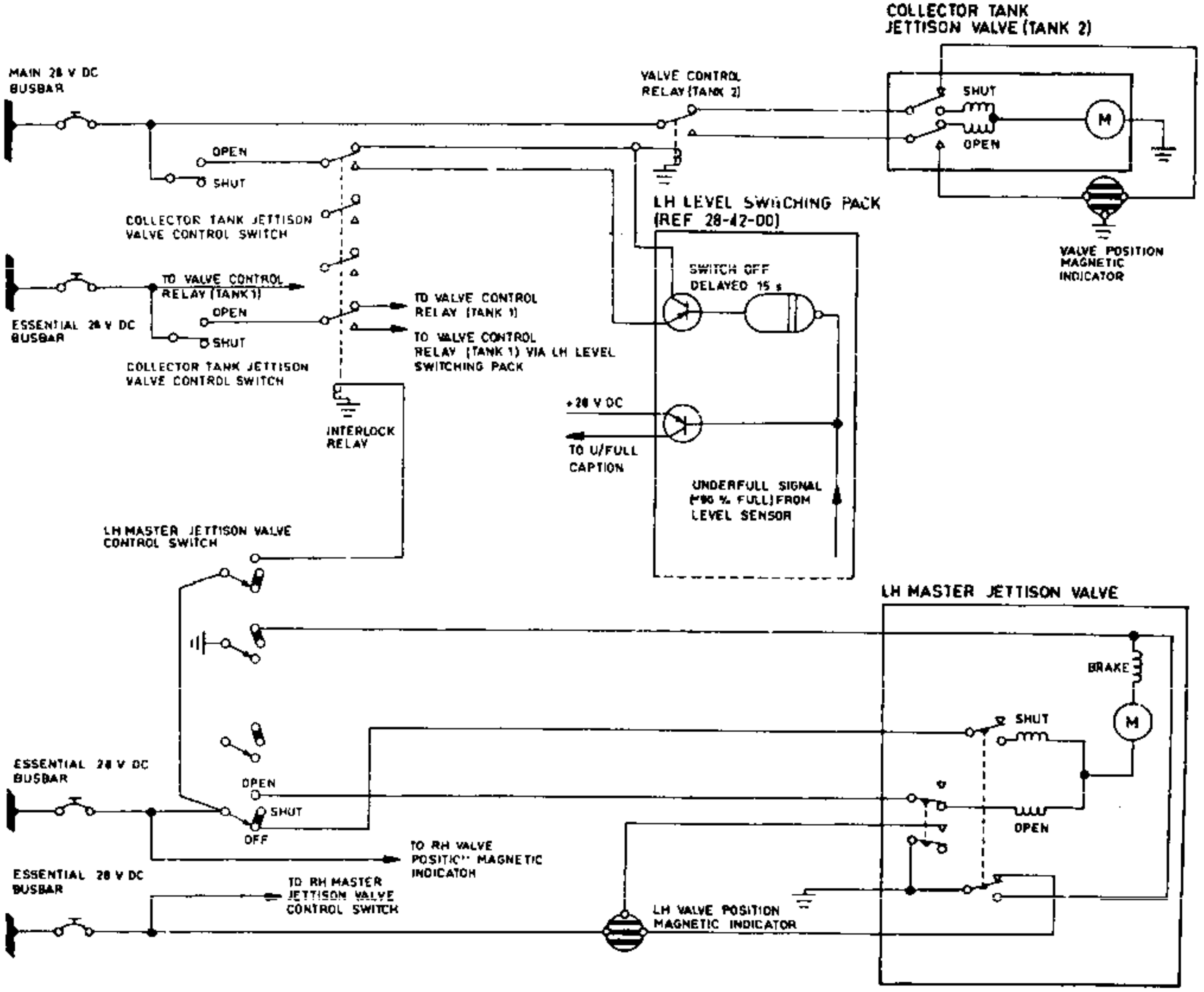

- Jettison Valves (Typical) - Control and Indication -
Simplified Schematic
Figure 006

R

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motor stops and the valve position magnetic indicator displays bar-in-line. Subsequently, when the control switch is set to SHUT, the valve control relay is de-energized and 28 V d.c. is applied, via the valve control relay, to the 'shut' coils of the valve motor. The valve shuts and the limit switches change over, the motor stops and the valve position magnetic indicator displays bar-across-line.

For fuel jettison, the master jettison valves and the collector tank jettison valves are opened.

When the master jettison valve control switch is set to OPEN, 28 V d.c. is applied to the 'open' coils of the valve motor. The valve opens and the limit switches change over, the motor stops and the valve position magnetic indicator displays bar-in-line. In addition, the interlock relay is energized and its contacts route the control circuit of the valve control relay through a transistor in the level switching pack (Ref. 28-42-00).
Subsequently, when the collector tank jettison valve control switch is set to OPEN, the valve control relay is energized via contacts of the energized interlock relay and the transistor (conducting) in the level switching pack, and the collector tank jettison valve opens as previously described. If the fuel quantity in the associated collector tank falls below 80 per cent, an underfull signal is generated in the level switching pack which causes -

(1) a transistor in the underfull caption circuit (Ref. 28-42-03) to conduct, thereby illuminating the U/FULL caption, and

(2) the transistor in the control circuit of the valve control relay to cease conducting after a 15 s delay, thereby de-energizing the relay which, in turn, changes over the 28 V d.c. supply to the valve, and the collector tank jettison valve shuts.

With the master jettison valves and the collector tank jettison valves open, when the control switches are set to SHUT, the interlock relays and the valve control relays are de-energized, the valves shut and the associated magnetic indicators display bar-across-line.

7. <u>Electrical Power Supplies</u>

Electrical power supplies for the equipment in the jettison system are detailed in Table 1.

SERVICE	BUSBAR	CIRCUIT BREAKER PANEL
Master jettison valve LH supply and (RH) indication	'B' essential 28 V d.c.	3-213
Master jettison valve RH supply and (LH) indication	'A' essential 28 V d.c.	1-213
Jettison valve tank 1 supply	'B' essential 28 V d.c.	3-213
Jettison valve tank 2 supply	'B' main 28 V d.c.	15-216
Jettison valve tank 3 supply	'A' essential 28 V d.c.	1-213
Jettison valve tank 4 supply	'A' main 28 V d.c.	15-215

Electrical Power Supplies
Table 1

DUMP SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. paras.3., 4. and 5.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

Where circuits are similar and incorporate identical components (i.e., tank 1, tank 2, tank 3 and tank 4 jettison valves) all references to the associated components listed in Table 101 are given, e.g., 'Renew Collector Tank Jettison Valve (27), (28), (29) or (30)'.

2. Preparation

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Multimeter	-
Receptacle, 10 gal (45 l), for fuel spillage	-
Bonding lead, for receptacle	-

B. Prepare

(1) Ensure that the associated circuit breakers are set (Ref. Table 101).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel access door is shut.

(4) Place placards at both panels, warning that the settings of the switches must not be altered.

CAUTION: IF FUEL IS TO BE TRANSFERRED, OBSERVE THE CG LIMITATIONS (REF. 28-00-00, SERVICING, 'FUEL TRANSFER ON THE GROUND').

(5) If fuel is to be transferred during this trouble shooting (Ref. para.5., 'Auto Shut-off'), proceed as follows:-

(a) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft is laterally level (0 deg roll) and between 5 min nose-down and 1 deg 55 min nose-up pitch. Reposition the aircraft if necessary.

(b) Ensure that the Main Transfer System (Ref. 28-22-00) and the Engine Feed System (Ref. 28-21-00) are serviceable.

(c) At the third crew member's (3CM) station, panel

6-214, press the LIGHTS CTR switch to "TEST" and check that all captions on the fuel management panel are illuminated.

(d) Position a 10 gal (45 l) receptacle, electrically bonded to the aircraft, to collect any fuel that may issue from the jettison outlet.

3. Trouble Shooting - Collector Tank Jettison Valve

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *At the 3CM station, panel 2-214, check  *
  *that the collector tank jettison valve  *
  *control switch is at SHUT;  check that  *
  *valve magnetic indicator displays bar-  *
  *across-line;  check that mechanical     *
  *indicator on collector tank jettison    *
  *valve is at SHUT.                       *
  *Set control switch to "OPEN". Check     *
  *that the valve magnetic indicator       *
  *display changes from bar-across-line to *
  *diagonal stripes, then to bar-in-line   *
  *within 3 s;  check that mechanical      *
  *indicator on collector tank jettison    *
  *valve is at OPEN.                       *
  *Set control switch to "SHUT";  check    *
  *that valve magnetic indicator display   *
  *changes from bar-in-line to diagonal    *
  *stripes, then to bar-across-line within *
  *3 s; check that mechanical indicator on *
  *collector tank jettison valve is at     *
  *SHUT.  IF -                             *
  *******************************************
             |
             |                ---------------------------------
             |               |1. Valve does not open/shut when|
           NOT OK------------|   control switch operated SHUT-|
                             |   OPEN-SHUT - Chart 101.       |
                             |2. Valve position magnetic      |
                             |   indicator faulty, with       |
                             |   correct valve operation -    |
                             |   Chart 102.                   |
                              ---------------------------------
```

4. Trouble Shooting - Master Jettison Valve

```
A.*****************************************
  *Prepare to trouble shoot (Ref. para.2.)*
  *At the 3CM station, panel 2-214, check *
  *that the master jettison valve control *
  *switch is at OFF;  check that valve    *
  *magnetic indicator displays bar-across-*
  *line; check that mechanical indicator  *
  *on master jettison valve is at S.      *
  *Set control switch to "OPEN";  check   *
  *that the valve magnetic indicator      *
  *display changes from bar-across-line to*
  *diagonal stripes, then to bar-in-line  *
  *within 3 s; check that mechanical      *
  *indicator on master jettison valve is  *
  *at O.                                  *
  *Set control switch to "SHUT"; check    *
  *that valve magnetic indicator display  *
  *changes from bar-in-line to diagonal   *
  *stripes, then to bar-across-line within*
  *3 s; check that mechanical indicator on*
  *master jettison valve is at S.         *
  *Set control switch to "OFF"; check that*
  *valve magnetic indicator displays bar- *
  *across-line.                           *
  *****************************************
     |          |
     |          |                   --------------------------------
     |        NOT OK---------------|1. Valve does not open/shut when|
     |                             |   control switch operated SHUT-|
     |                             |   OPEN-SHUT - Chart 103.       |
     |                             |2. Valve position magnetic      |
     |                             |   indicator faulty, with       |
     |                             |   correct valve operation -    |
     |                             |   Chart 105.                   |
     |                              --------------------------------
     |
```

```
     |
     OK
     |
B.*********************************************
  *Set control switch to "OPEN"; check that   *
  *valve magnetic indicator displays bar-in-  *
  *line.                                      *
  *Set control switch to "OFF"; check that    *
  *valve magnetic indicator display changes   *
  *from bar-in-line to diagonal stripes and   *
  *then to bar-across-line within 3 s; check  *
  *that mechanical indicator on the valve is  *
  *at S.  IF -                                *
  *********************************************
                  |
                  |                -----------------------------------
                  |               |1. Valve does not open/shut when   |
                  NOT OK------|   control switch operated OFF-  |
                              |   OPEN-OFF - Chart 104.         |
                              |2. Valve position magnetic indi-  |
                              |   cator faulty, with correct    |
                              |   valve operation - Chart 105.  |
                               -----------------------------------
```

5. Trouble Shooting - Auto Shut-off

A. Prepare to trouble shoot (Ref. para.2.) At the 3CM station, panel 2-214, check that the master jettison valve control switch is at OFF; check that valve position magnetic indicator displays bar-across-line; check that mechanical indicator on master jettison valve is at S. Disconnect the free connector from the valve; cover and stow the connector. At the 3CM station, check that tank fuel quantity is above U/FULL level (80 per cent)** and U/FULL caption is not illuminated. Set master jettison valve control switch to "OPEN"; set tanks 5 and 6 (LH system) or tanks 7 and 8 (RH system) standby inlet valve control switches to "OPEN"; set collector tank jettison valve control switch to "OPEN"; set standby engine feed pump switches to "ON". Check that U/FULL caption is illuminated when fuel level falls to 80 per cent and, in not less than 15 s, the collector tank valve position magnetic indicator displays bar-across-line.

**Approximately 3,350 kg for tanks 1 and 4 or 3,650 kg for tanks 2 and 3 at fuel specific gravity 0.80.

OK

NOT OK -- 1. Collector tank jettison valve does not shut automatically - renew Level Switching Pack (31) or (32). If not OK, refer to 28-42-00, Trouble Shooting.

B.**
*Set master jettison valve control *
*switch to "SHUT"; check that collector *
*tank jettison valve re-opens. Set *
*standby engine feed pump switches to *
*"OFF". Set collector tank jettison *
*valve control switch to "SHUT". Set *
standby inlet valve control switches to
*"SHUT". Set master jettison valve *
control switch to "OFF". Reconnect free
connector to master jettison valve, and
*carry out Functional Test of valve *
*(Ref. Adjustment/Test). *
****

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VALVE DOES NOT OPEN/SHUT WHEN CONTROL SWITCH OPERATED "SHUT-OPEN-SHUT".

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

R With electrical power on and control switch at SHUT, disconnect electrical connector at Collector Tank Jettison Valve (27), (28), (29) or (30). Check free connector for 28 V d.c. at pin C. With control switch at OPEN, check free connector for 28 V d.c. at pin B. R

-YES- With collector tank jettison valve at SHUT, check for continuity between valve fixed connector pins A-B. Or, with valve at OPEN, check for continuity between pins A-C.

-NO-- Renew Collector Tank Jettison Valve (27), (28), (29) or (30).

NO

Continued on Sheet 2

Chart 101 (Sheet 1 of 2)

Continued from Sheet 1

```
           |
 Continued from Sheet 1
           |
           |
 -----------          -----------          -----------
|Check CB   |        |Set control|        |*Renew     |
|(3), (4),  |-YES-   |switch to  |-YES-   |Valve      |
|(5) or (6) |        |"OPEN"; at |        |Control    |
|for 28 V   |        |LH or RH   |        |Relay (19),|
|d.c.       |        |fuel relay |        |(20),(21)  |
|output.    |        |box (panel |        |or (22).   |
 -----------         |15-123 or  |         -----------
      |              |18-123),   |
      |              |check for  |
      NO             |28 V d.c.  |
      |              |at test    |
      |              |point -    |
 -----------         |UT 1851-A3 |
|Renew CB   |        |(tank 1),  |
|(3), (4),  |        |UT 1851-C2 |
|(5) or (6).|        |(tank 2),  |
 -----------         |UT 1852-A2 |
                     |(tank 3),  |
                     |UT 1852-C2 |
                     |(tank 4).  |
                      -----------
                           |
                           NO
                           |
 -----------          -----------                                  -----------
|*Renew     |        |Remove the |                                |*Renew     |
|Control    |-NO--   |LH or RH   |-----------YES----------        |Interlock  |
|Switch (15)|        |Interlock  |                                |Relay (13) |
|(16), (17) |        |Relay, (13)|                                |or (14).   |
|or (18).   |        |or (14);   |                                 -----------
 -----------         |check for  |
                     |28 V d.c.  |
                     |at relay   |
                     |socket pin |
                     |B2 (tank 1 |
                     |or 3) or   |
                     |pin A2     |
                     |(tank 2 or |
                     |4).        |
                      -----------
```

Chart 101 (Sheet 2 of 2)

VALVE POSITION MAGNETIC INDICATOR FAULTY, WITH CORRECT VALVE OPERATION.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

With electrical power on and control switch at SHUT, check valve Position Indicator (23),(24), (25) or (26), for 28 V d.c. at pin A. With control switch at OPEN, check indicator for 28 V d.c. at pin C.

- YES → Renew Valve Position Indicator (23),(24), (25) or (26).
- NO → *Renew Collector Tank Jettison Valve (27) (28),(29) or (30).

Chart 102

VALVE DOES NOT OPEN/SHUT WHEN CONTROL SWITCH OPERATED "SHUT-OPEN-SHUT".

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

<u>NOTE</u>: Before renewal of components (*), check the associated wiring for continuity.

Box 1: With electrical power on, set control switch to "SHUT";
R disconnect electrical connector at Master Jettison Valve (11) or (12). Check free connector
R for 28 V d.c. at pin C. With control switch at OPEN, check free connector for 28 V d.c. at pin B.

- YES → **Box 2:** With master jettison valve at shut (S), check for continuity between valve fixed connector pins A-B. Or, with valve at open (O), check for continuity between pins A-C.
  - NO → Renew Master Jettison Valve (11) or (12).
- NO → **Box 3:** Check CB (1) or (2) for 28 V d.c. output
  - YES → *Renew Jettison Master Switch (7) or (8).
  - NO → Renew CB (1) or (2)

Chart 103

```
*******************************        ------------------------------
*VALVE DOES NOT OPEN/SHUT WHEN*       |GROUND EQUIPMENT REQUIRED     |
*CONTROL SWITCH OPERATED      *       |------------------------------|
*"OFF-OPEN-OFF".              *       |DESCRIPTION           PART NO.|
*******************************       |------------------------------|
                                      |GROUND POWER SUPPLY   -       |
                                      |MULTIMETER            -       |
                                       ------------------------------
```

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 ----------------       ---------------------          ------------
|With electrical |     |With master jettison |        |Renew Master|
|power on, set   |-YES-|valve shut (at S),   |-NO-    |Jettison    |
|control switch  |     |check for continuity |        |Valve (11) or|
|to "OFF"; dis-  |     |between valve fixed  |        |(12).       |
|connect electri-|     |connector pins A-B.  |         ------------
|cal connector at|     |Or, with valve open  |
|Master Jettison |     |(at O), check for    |
|Valve (11) or   |     |continuity between   |
|(12). Check free|     |pins A-C.            |
|connector for 28|      ---------------------
|V d.c. at pin C.|
|With control    |      ---------------------          -----------
|switch at OPEN, |     |Check CB (1) or (2)  |        |*Renew Jet- |
|check free con- |-NO--|for 28 V d.c. output.|-YES-   |tison Master|
|nector for 28 V |      ---------------------         |Switch (7)  |
|d.c. at pin B.  |               |                    |or (8).     |
 ----------------               NO                     -----------
                                 |
                        ---------------------
                       |Renew CB (1) or (2). |
                        ---------------------
```

Chart 104

```
***************************
*VALVE POSITION MAGNETIC *
*INDICATOR FAULTY, WITH  *
*CORRECT VALVE OPERATION.*
***************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the associated wiring for continuity.

```
 -----------       -----------       -----------
|With elect-|     |Disconnect |     |*Renew     |
|rical power|-YES-|electrical |-YES-|Master     |
|on, check  |     |connector  |     |Jettison   |
|for 28 V   |     |at Master  |     |Valve (11) |
|d.c. output|     |Jettison   |     |or (12).   |
|at CB (1)  |     |Valve (11) |      -----------
|for LH     |     |or (12).   |
|position   |     |Check free |
|indicator  |     |connector  |
|or CB (2)  |     |for 28 V   |
|for RH     |     |d.c. at    |
|position   |     |pins D and |
|indicator. |     |E.         |
 -----------       -----------
      |                 |
      |                 |
      NO                NO
      |                 |
 -----------       -----------
|Renew CB   |     |*Renew     |
|(1) or (2).|     |Valve      |
 -----------      |Position   |
                  |indicator  |
                  |(9) or (10)|
                   -----------
```

Chart 105

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R **ON A/C 006-007, (1) Circuit breaker 28 V	-	1-213	2Q302	Map ref.K17	24-50-00 R/I	28-31-05
**ON A/C 001-005, (1) Circuit breaker 28 V	-	1-213	2Q302	Map ref.K18	24-50-00 R/I	28-31-05
**ON A/C ALL (2) Circuit breaker 28 V	-	3-213	1Q302	Map ref.A7	24-50-00 R/I	28-31-05
(3) Circuit breaker 28 V	-	3-213	Q131	Map ref.C7	24-50-00 R/I	28-31-01
(4) Circuit breaker 28 V	-	15-216	Q132	Map ref.B7	24-50-00 R/I	28-31-01
(5) Circuit breaker 28 V	-	1-213	Q133	Map ref.L11	24-50-00 R/I	28-31-02
(6) Circuit breaker 28 V	-	15-215	Q134	Map ref.D20	24-50-00 R/I	28-31-02
(7) Jettison master switch, LH	-	2-214	1Q305	Fuel management panel (3CM)	28-00-00 R/I	28-31-05
(8) Jettison master switch, RH	-	2-214	2Q305	Fuel management panel (3CM)	28-00-00 R/I	28-31-05
(9) Jettison valve position indicator, LH	-	2-214	1Q309	Fuel management panel (3CM)	28-00-00 R/I	28-31-05
(10) Jettison valve position indicator, RH	-	2-214	2Q309	Fuel management panel (3CM)	28-00-00 R/I	28-31-05
(11) Master jettison valve	Via tail	-	1Q311	Rear fuselage, aft	28-31-32 R/I	28-31-05

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
LH	wheel bay			of tank 11		
(12) Master jettison valve, RH	Via tail wheel bay	-	2Q311	Rear fuse- lage, aft of tank 11	28-31-32 R/I	28-31-05
(13) Interlock relay (tanks 1 and 2)	-	15-123	1Q306	LH fuel relay box, fwd. under- floor racking	28-00-00 R/I	28-31-05
(14) Interlock relay (tanks 3 and 4)	-	18-123	2Q306	RH fuel relay box, fwd. under- floor racking	28-00-00 R/I	28-31-05
(15) Control switch (tank 1)	-	2-214	Q139	Fuel management panel (3CM)	28-00-00 R/I	28-31-01
(16) Control switch (tank 2)	-	2-214	Q140	Fuel management panel (3CM)	28-00-00 R/I	28-31-01
(17) Control switch (tank 3)	-	2-214	Q141	Fuel management panel (3CM)	28-00-00 R/I	28-31-02
(18) Control switch (tank 4)	-	2-214	Q142	Fuel management panel (3CM)	28-00-00 R/I	28-31-02
(19) Control relay (tank 1)	-	15-123	Q143	LH fuel relay box, fwd. under- floor racking	28-00-00 R/I	28-31-01
(20) Control relay (tank 2)	-	15-123	Q144	LH fuel relay box, fwd. under-	28-00-00 R/I	28-31-01

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				floor racking		
(21) Control relay (tank 3)	-	18-123	Q145	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-31-02
(22) Control relay (tank 4)	-	18-123	Q146	RH fuel relay box, fwd. under-floor racking	28-00-00 R/I	28-31-02
(23) Indicator (tank 1)	-	2-214	Q135	Fuel management panel (3CM)	28-00-00 R/I	28-31-01
(24) Indicator (tank 2)	-	2-214	Q136	Fuel management panel (3CM)	28-00-00 R/I	28-31-01
(25) Indicator (tank 3)	-	2-214	Q137	Fuel management panel (3CM)	28-00-00 R/I	28-31-02
(26) Indicator (tank 4)	-	2-214	Q138	Fuel management panel (3CM)	28-00-00 R/I	28-31-02
(27) Collector tank jettison valve (1)	EB	193	Q147	Tank 1, inboard	28-31-11 R/I	28-31-01
(28) Collector tank jettison valve (2)	KB	195	Q148	Tank 2, inboard	28-31-11 R/I	28-31-01
(29) Collector tank jettison valve (3)	KB	196	Q149	Tank 3 inboard	28-31-11 R/I	28-31-02
(30) Collector tank jettison	EB	194	Q150	Tank 4, inboard	28-31-11 R/I	28-31-02

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
valve (4)						
(31) Level switching pack, LH	-	10-216	Q1350	RH flight compartment racking	28-42-51 R/I	28-42-05
(32) Level switching pack, RH	-	2-216	Q1351	RH flight compartment racking	28-42-51 R/I	28-42-07

Component Identification
Table 101

DUMP SYSTEM - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

This topic comprises procedures for the removal and installation of the pipes in the dump system between frames 88 and 96. If removal of a single pipe is required, the adjoining pipes may have to be moved sufficiently to effect removal; in this case the appropriate part of these procedures must be followed.

End-float of each pipe within its couplings is provided for thermal expansion, but also facilitates removal of a single pipe.

When Gamah couplings are being installed, the general requirements detailed in 20-23-21 and the pipe end-float (Ref. Table 401) must be observed.

In the event of damage to the dry lubricant coating on the Gamah couplings, the procedure for the application of dry lubricant must be followed in accordance with 20-24-35.

In the following procedures, pipes are identified by frame reference annotations (e.g., Pipe F91-93), as illustrated. Each pipe is dealt with individually, under its specific heading; a separate Preparation (Ref. para.2.) is applicable to all pipes.

Access to all pipes is gained via the tail gear doors, after the gear has been lowered and the ground locking sleeve fitted.

2. Preparation

NOTE: This procedure applies to all pipes.

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare to Remove Pipe

(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing) and that the refuelling access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that the position of the switches must not be changed.

(3) Lower the tail gear; fit a locking sleeve to the gear jack (Ref. 12-37-00, Tail Gear Wheel).

(4) Trip the following circuit breakers and fit safety clips:-

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K17
LH JET MASTER VALVE SUP & IND	3-213	1Q302	A7
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

**ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K18
LH JET MASTER VALVE	3-213	1Q302	A7

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SUP & IND			
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

3. Pipe F89-90 (Ref. Fig.401 and 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

NOTE: These procedures apply to either pipe at F89-90.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Sealant, PR 1422BT (Ref. 20-30-00, No.379)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Pipe F89-90

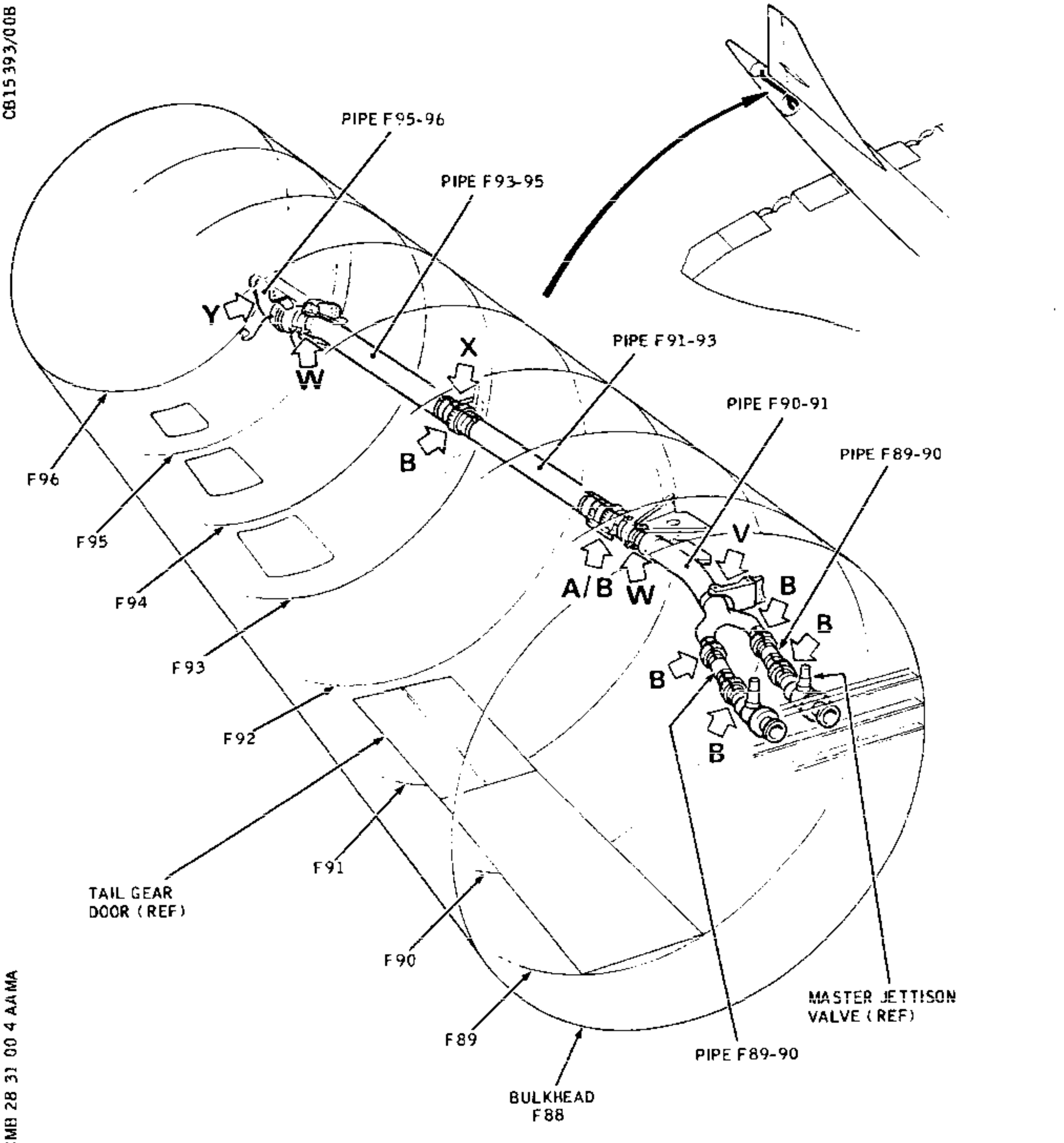
(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Pipe F89-90

(1) Carefully cut and remove the ligatures securing the bonding leads near to the coupling nut at each end of the pipe. Discard the ligatures.

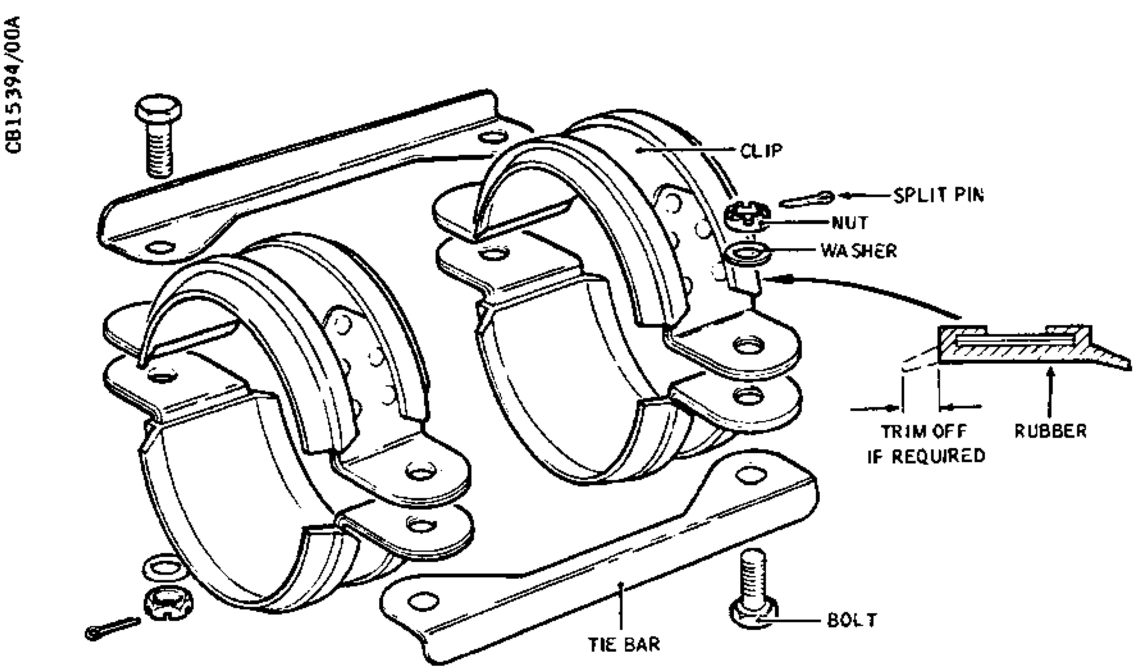
(2) Remove the nuts, washers and bolts securing the

CB15 393/00B

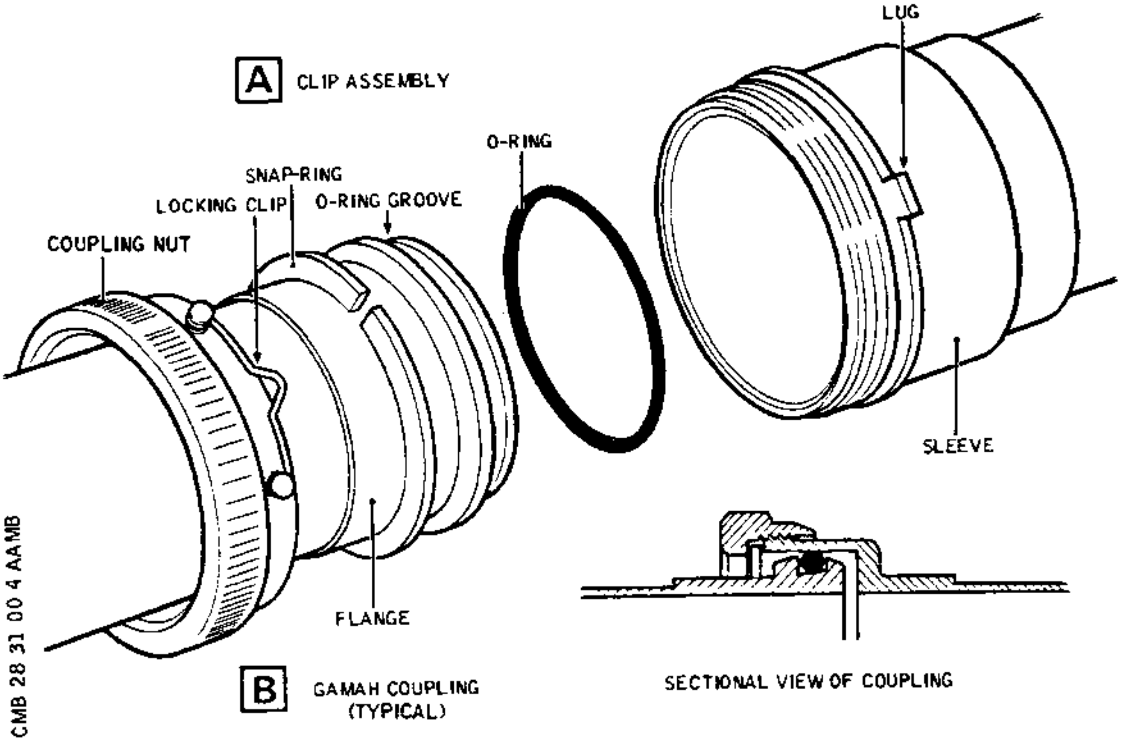


CMB 28 31 00 4 AAMA

- Pipes and Attachments - Installation (Sheet 1 of 4)
Figure 401



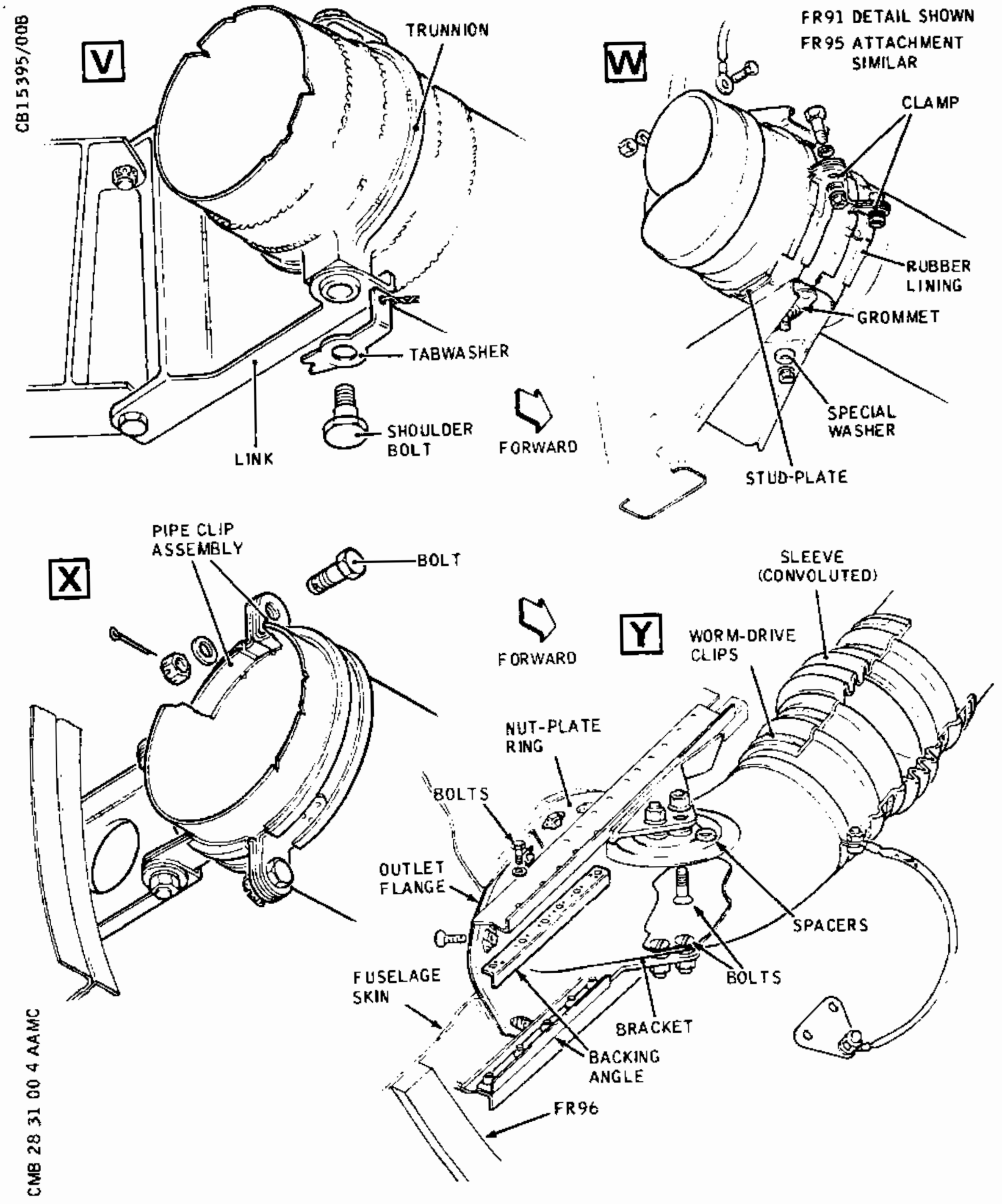
A CLIP ASSEMBLY



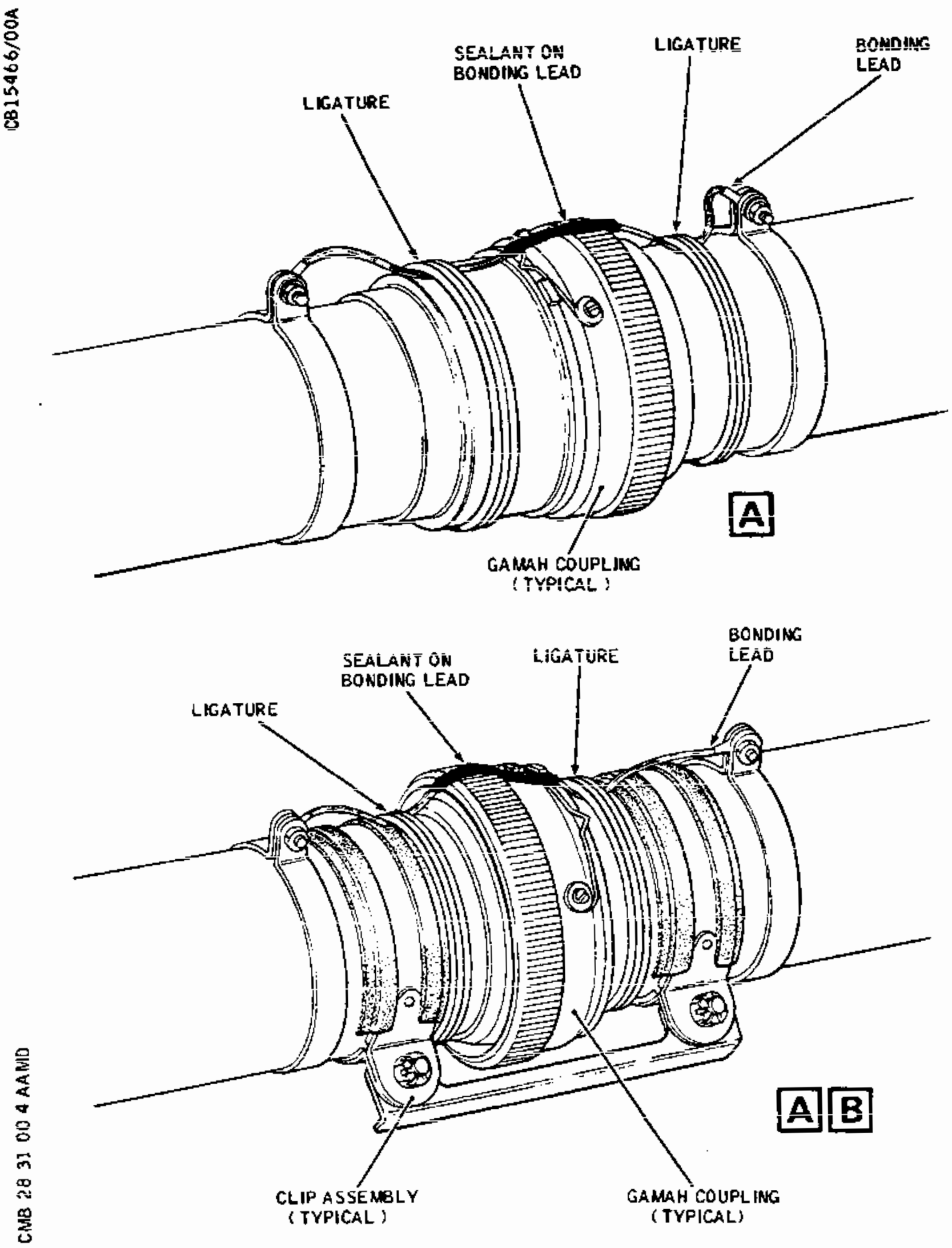
B GAMAH COUPLING (TYPICAL)

SECTIONAL VIEW OF COUPLING

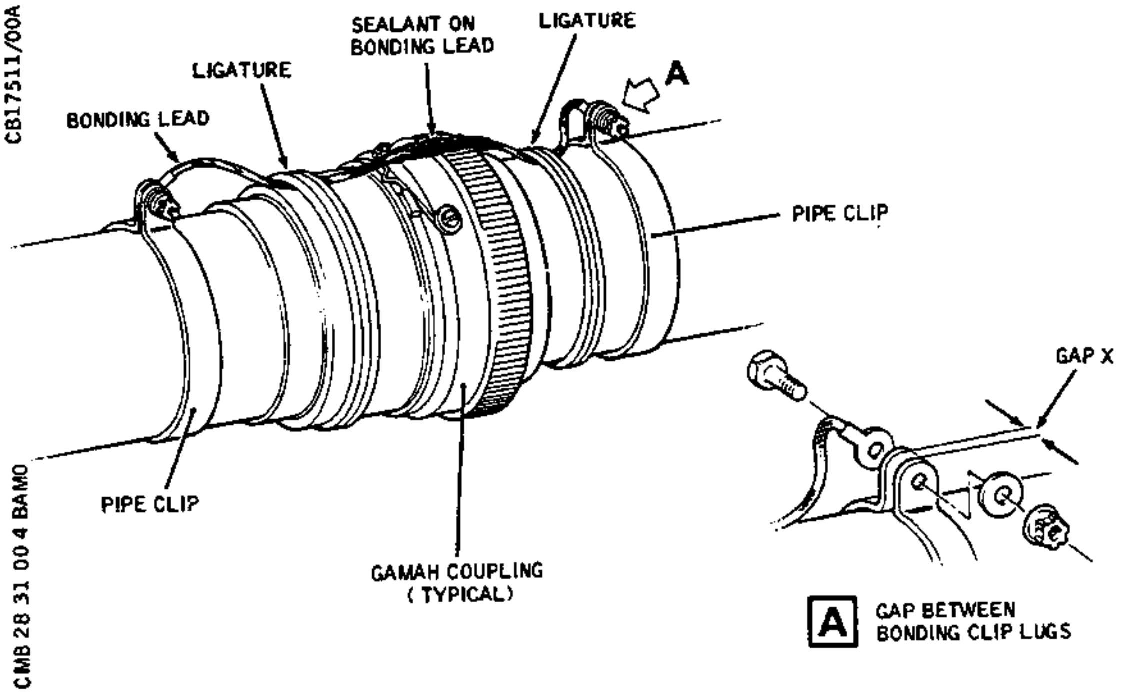
- Pipes and Attachments - Installation (Sheet 2 of 4)
Figure 401



- Pipes and Attachments - Installation (Sheet 3 of 4)
Figure 401



- Pipes and Attachments - Installation (Sheet 4 of 4)
Figure 401



- Typical Bonding Clip - Installation (Ref. Table 402)
Figure 402

bonding leads to the clips on the pipe. Carefully move the clips toward the centre of the pipe, ensuring that the protective treatment on the pipe is not damaged.

(3) Fully unscrew both coupling nuts and slide them, and the snap-rings, along the pipe away from the flanges (Detail B).

(4) Move the pipe forward (toward the bulkhead) until the rear end of the pipe is clear of the sleeve.

(5) Move the pipe sideward the minimum amount, without straining it, until the flange is clear of the sleeve; carefully ease the pipe rearward and remove it.

(6) Remove and discard the O-rings from the pipe flanges.

(7) Fit suitable blanks to the open ends of all pipes.

COUPLING POSITION, NEAREST FRAME	END-FLOAT (in)	(mm)
89 (either pipe)	0.2 (nominal)	5.08 (nominal)
90 (either pipe)	0.2(+0.2 -0.1)	5.08(+5.08 -2.54)
91	0.2(±0.02)	5.08(±0.508)
93	0.6(±0.1)	15.24(±2.54)

Gamah Coupling End-float
Table 401

D. Install Pipe F89-90

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Ensure that the pipes and joints are clean.

(4) Lubricate new O-rings in accordance with 20-23-11 and fit them to the pipe flanges.

(5) Position the pipe with its flange partly entered into the forward sleeve; move the pipe forward, ensuring that the O-ring is not damaged and the pipe is not strained.

(6) Align the rear flange and slide it into the sleeve, ensuring that the O-ring is not damaged.

(7) Position the pipe so that the end-float (Ref. 20-23-21) at each coupling is that listed in Table 401.

(8) Reposition the snap-ring and nut of each coupling; tighten and lock the nuts in accordance with 20-23-21.

(9) Check that the angular malalignment of each coupling (Ref. 20-23-21) does not exceed 1 deg 30 min.

(10) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be

fitted between the lugs, as detailed in Table 402 (Ref. Fig. 402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(11) Apply ligatures and adhesive in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 401).

(12) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(13) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

GAP X, WITH LUGS HELD TOGETHER BY FINGER PRESSURE	SPACING WASHER(S) TO BE FITTED BETWEEN LUGS	
	WASHER	QTY.
0.010 to 0.059 in (0.254 to 1.498 mm)	-	0
0.060 to 0.119 in (1.524 to 3.022 mm)	Y	1
0.120 to 0.169 in (3.048 to 4.292 mm)	Z	1
0.170 to 0.209 in (4.318 to 5.308 mm)	Y and Z	1 of each

NOTE: Washer Y thickness: 0.048 in (1.219 mm)

Washer Z thickness: 0.104 in (2.641 mm)

9

Bonding Clip Lug Gap and Spacing Washers (Ref. Fig.402)
Table 402

E. Conclusion

(1) Check that the electrical bonding between the pipes is in accordance with 20-27-11.

(2) Carry out a Leakage Test as detailed in 28-31-32, Adjustment/Test.

(3) Ensure that all tools, equipment, etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(6) Remove the placards from the fuel management and refuel control panels.

4. Pipe F90-91 (Ref. Fig.401 and 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 15 to 20 lbf in (0.169 to 0.226 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Pipe F90-91

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Pipe F90-91

(1) Carefully cut and remove the ligatures securing the bonding leads near to the coupling nuts on the pipe.

Discard the ligatures.

(2) Remove the nuts, washers and bolts securing the bonding leads to the clips on the pipes. Carefully move the clips away from the coupling nuts, ensuring that the protective treatment on the pipe is not damaged.

(3) Fully unscrew the two coupling nuts (Detail B) at the forward end of the pipe.

(4) At the rear end of the pipe (Details A and B) remove the split pins, nuts, washers, bolts, tie bars and clips; fully unscrew the coupling nut and move it and the snap-ring away from the flange.

(5) At frame 90 (Detail V) remove the two shoulder bolts and tabwashers securing the pipe to the link.

(6) At frame 91 (Detail W) remove the nuts, washers and bolts securing the two clamps and rubber linings to the pipe fitting; slacken the nuts on the stud-plates and then remove the clamps and rubber linings.

NOTE: The rear clamp joints at frame 91 only are offset 30 deg.

(7) Move the pipe rearward until the sleeves of the 'Y' branch are clear of the flanges.

(8) Move the pipe sideward the minimum amount, without straining it, until the rear flange is clear of the sleeve; carefully ease the pipe forward and remove it.

(9) At frame 91 (Detail W) remove from the stud-plates the nuts and special washers and then remove the stud-plates from the brackets.

(10) Remove and discard the O-rings from the pipe flanges.

(11) Fit suitable blanks to the open ends of all pipes.

D. Install Pipe F90-91

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Ensure that the pipes and joints are clean.

(4) Lubricate new O-rings in accordance with 20-23-11 and fit them to the pipe flanges.

(5) At frame 91 (Detail W) assemble the stud-plates on the brackets by inserting the studs in the grommets, first ensuring that the grommets are clean and undamaged; secure the stud-plates with the nuts and special washers but do not tighten the nuts at this stage.

(6) Position the pipe with the rear flange partly entered into the sleeve; move the pipe rearward, ensuring that the O-ring is not damaged and the pipe is not strained.

(7) Align the two sleeves on the 'Y' branch with the flanges on the two forward pipes; slide the sleeves over the flanges, ensuring that the O-rings are not damaged.

(8) Position the adjoining pipes so that the end-float (Ref. 20-23-21) at each coupling is that listed in Table 401.

(9) At frame 91 (Detail W) centralize the stud-plates on the flat surfaces of the pipe-fitting and then attach the stud-plates to the pipe with the clamps and rubber linings, nuts and bolts, with washers under the bolt-heads and nuts; ensure that the flat surfaces on the clamps coincide with the flat surfaces on the stud-plates; torque-tighten the clamp assembly nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN); torque-tighten the stud-plate nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

(10) At frame 90 (Detail V) align the holes in the link and trunnion and fit the tabwashers and shoulder bolts; torque-tighten the bolts to between 15 and 20 lbf in (0.169 and 0.226 mdaN). Lock the heads of the bolts with the tabwashers, and lock the tabwashers with wire in accordance with 20-21-13.

(11) Check that the end-float at each coupling is still satisfactory (Ref. Table 401).

(12) Reposition the snap-ring and nut of each coupling; tighten and lock the nuts in accordance with 20-23-21.

(13) Check that the angular malalignment of the pipe couplings (Ref. 20-23-21) does not exceed the following amounts:-

(a) Two couplings on the 'Y' branch: 1 deg 30 min.

(b) Rear coupling: 1 deg.

(14) At the rear end of the pipe, position the clips (Detail A) each side of the coupling with the clip rubber in close contact with the end of the Gamah coupling; trim the rubber as required (Ref. Fig. 401). Maintaining the correct end-float, attach the tie bars with the bolts, washers and nuts; torque-tighten the nuts to between 25 and 30 lbf in (0.282 and 0.339 mdaN) and fit split pins.

(15) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 402 (Ref. Fig. 402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(16) Apply ligatures and adhesive in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 401).

(17) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(18) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes is in accordance with 20-27-11.

(2) Carry out a Leakage Test as detailed in 28-31-32, Adjustment/Test.

(3) Ensure that all tools, equipment, etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Remove the safety clips and reset the circuit

breakers previously tripped (Ref. para.2.B.(4)).

(6) Remove the placards from the fuel management and refuel control panels.

5. Pipe F91-93 (Ref. Fig.401 and 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Sealant, PR 1422BT, (Ref. 20-30-00, No.357) R	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Pipe F91-93

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Pipe F91-93

(1) Carefully cut and remove the ligatures securing the bonding leads near to the coupling nuts on the pipe. Discard the ligatures.

(2) Remove the nuts, washers and bolts securing the bonding leads to the clips on the pipe. Carefully move the clips away from the coupling nuts, ensuring that the protective treatment on the pipe is not damaged.

(3) At the forward end of the pipe (Details A and B)) remove the split pins, nuts, washers, bolts, tie bars and clips; fully unscrew the coupling nut.

(4) At the rear end of the pipe (Detail B) fully unscrew the coupling nut and move it and the snap-ring away

from the flange.

(5) Move the pipe rearward until the sleeve at the forward end is off the flange.

(6) Move the pipe sideward the minimum amount, without straining it, until the sleeve is clear of the flange; carefully ease the pipe forward and remove it.

(7) Remove and discard the O-rings from the pipe flanges.

(8) Fit suitable blanks to the open ends of all pipes.

D. Install Pipe F91-93

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Ensure that the pipes and joints are clean.

(4) Lubricate new O-rings in accordance with 20-23-11 and fit them to the pipe flanges.

(5) Position the pipe with the rear flange partly entered into the sleeve; move the pipe rearward, ensuring that the O-ring is not damaged and the pipe is not strained.

(6) Align the sleeve and flange at the forward end of the pipe; slide the sleeve over the flange, ensuring that the O-ring is not damaged.

(7) Position the pipe so that the end-float (Ref. 20-23-21) at each coupling is that listed in Table 401.

(8) Reposition the snap-ring and nut at each coupling; tighten and lock the nuts in accordance with 20-23-21.

(9) Check that the angular malalignment of each coupling (Ref. 20-23-21) does not exceed 1 deg.

(10) At the forward end of the pipe, position the clips (Detail A) each side of the coupling with the clip rubber in close contact with the end of the Gamah coupling; trim the rubber as required (Ref. Fig. 401). Maintaining the correct end-float, attach the tie bars with the bolts, washers and nuts; torque-tighten the nuts to between 25 and 30 lbf in

(0.282 and 0.339 mdaN) and fit split pins.

(11) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 402 (Ref. Fig. 402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(12) Apply ligatures and adhesive in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 401).

(13) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(14) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes is in accordance with 20-27-11.

(2) Carry out a Leakage Test as detailed in 28-31-32, Adjustment/Test.

(3) Ensure that all tools, equipment, etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(6) Remove the placards from the fuel management and refuel panels.

6. Pipe F93-95 (Ref. Fig.401 and 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque-limiting screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 60 to 70 lbf in (0.678 to 0.791 mdaN)	-
Sealant, PR 1422BT R (Ref. 20-30-00, No.357)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

B. Prepare to Remove Pipe F93-95

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Pipe F93-95

(1) Carefully cut and remove the ligatures securing the bonding lead near to the coupling nut on the pipe. Discard the ligatures.

(2) Remove the nuts, washers and bolts securing the bonding leads to the clips on the pipe. Carefully move the clips away from the coupling nut at F93, and from the pipe attachment at F95, ensuring that the protective treatment on the pipe is not damaged.

(3) At the rear end of the pipe (Detail Y) release, at each worm-drive, the double worm-drive clips securing the convoluted sleeve.

(4) At the forward end of the pipe (Detail B) fully unscrew the coupling nut and move it and the snap-ring away from the flange.

(5) At frame 93 (Detail X) remove the split pins, nuts, washers, bolts and the free half of the clip.

(6) At frame 95 (Detail W) remove the nuts, washers and bolts securing the two clamps and rubber linings to the pipe fitting; slacken the nuts on the stud-plates and then remove the clamps and rubber linings.

(7) Move the pipe rearward until the forward sleeve is off the flange.

(8) Move the pipe sideward the minimum amount, without straining it, until the sleeve is clear of the flange; carefully ease the pipe forward, withdrawing the rear end from the convoluted sleeve.

(9) At frame 95 (Detail W) remove from the stud-plates the nuts and special washers, and then remove the stud-plates from the bracket.

(10) Remove and discard the O-rings from the flanges.

(11) Fit suitable blanks to the open ends of all pipes.

D. Install Pipe F93-95

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Ensure that the pipes, joints, and convoluted sleeve are clean and undamaged.

(4) Lubricate a new O-ring seal in accordance with 20-23-11 and fit it to the pipe flange.

(5) At frame 95 (Detail W) assemble the stud-plates on the brackets by inserting the studs in the grommets, first ensuring that the grommets are clean and undamaged; secure the stud-plates with the nuts and special washers but do not tighten the nuts at this stage.

(6) Position the pipe, carefully inserting the rear end into the convoluted sleeve.

(7) Slide the forward sleeve over the flange and position the pipe so that the end=float at the coupling (Ref. 20-23-21) is that listed in Table 401.

(8) At frame 93 (Detail X) position the clip, ensuring that the swinging link bracket is in its nominal mid-travel position, and fit the bolts, washers and nuts; torque-tighten the nuts to between 25 and

30 lbf in (0.282 and 0.339 mdaN) and fit split pins.

(9) Reposition the snap-ring and nut at the forward coupling; tighten and lock the nut in accordance with 20-23-21.

(10) Check that the angular malalignment of the coupling (Ref. 20-23-21) does not exceed 1 deg.

(11) At frame 95 (Detail W) centralize the stud-plates on the flat surfaces of the pipe fitting and then secure the stud-plates to the pipe with the clamps and rubber linings, nuts and bolts, with washers under the bolt-heads and nuts; ensure that the flat surfaces on the clamps coincide with the flat surfaces on the stud-plates; torque-tighten the clamp assembly nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN); torque-tighten the stud-plate nuts to between 60 and 70 lbf in (0.678 and 0.791 mdaN).

(12) Check that the end-float at the coupling is still satisfactory (Ref. Table 401).

(13) Position the double worm-drive clips on the convoluted sleeve with the worm drives directly below and above the pipe; torque-tighten the worm drives equally to between 14 and 18 lbf in (0.158 and 0.203 mdaN) and wire-lock them in accordance with 20-21-13.

(14) Reposition the bonding clips and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 402 (Ref. Fig. 402). Connect the bonding leads, in accordance with 20-27-11, using the bolts, washers and nuts; torque-tighten the nuts to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(15) Apply ligatures and adhesive in accordance with 20-23-14 to secure the bonding leads as illustrated (Ref. Fig. 401).

(16) Apply a brush-coating of sealant PR 1422BT to the bonding leads in areas of possible contact with knurled coupling nuts or flanges.

(17) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

E. Conclusion

(1) Check that the electrical bonding between the pipes is in accordance with 20-27-11.

(2) Carry out a Leakage Test as detailed in 28-31-32, Adjustment/Test.

(3) Ensure that all tools, equipment, etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(6) Remove the placards from the fuel management and refuel panels.

7. Pipe F95-96 (Ref. Fig.401 and 402)

WARNING: OBSERVE THE WARNING AT THE HEAD OF PAGE 401.

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 120 to 140 lbf in (1.356 to 1.582 mdaN)	-
Torque-limiting screwdriver, 14 to 18 lbf in (0.158 to 0.203 mdaN)	-
Torque-limiting screwdriver, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Viton sealant, PR 1720F, for sealing pipe flange/skin joint (Ref. 20-30-00, No.352)	-
Viton sealant, PR 1720SM (Ref. 20-30-00, No.351)	-

DESCRIPTION	PART NO.

B. Prepare to Remove Pipe F95-96

(1) Carry out the procedures detailed in paragraph 2.B.

C. Remove Pipe F95-96

(1) Remove the nut, washer and bolt securing the bonding lead to the clip on the pipe.

(2) At the forward end of the pipe (Detail Y) release, at worm-drive, the double worm-drive clips securing the convoluted sleeve.

(3) Using a screwdriver, hold the bolt-head steady within the bore of the pipe outlet and remove the nuts and spacers securing the pipe to the bracket; remove the bolts.

NOTE: The position of each bolt and spacer must be noted during removal. During installation, each bolt and spacer must be refitted in the position noted.

(4) Remove the bolts and washers securing the two backing angle and nut-strip assemblies near F96.

(5) At the flange end of the pipe, remove the countersunk bolts securing the flange to the fuselage skin.

(6) Using any suitable method that will not damage either the pipe flange or the fuselage skin, disengage the pipe flange.

(7) Move the pipe rearward and remove it.

(8) Fit suitable blanks to the open ends of all pipes.

D. Prepare to Install Pipe F95-96

(1) Carefully remove all sealant from the flange area on the fuselage skin.

(2) If the removed pipe is to be refitted, carefully remove the sealant from the flange.

E. Install Pipe F95-96

(1) Ensure that the safety precautions taken before removal have not been cancelled.

(2) Remove the blanks from the pipe ends.

(3) Ensure that the pipes and joints are clean.

(4) Apply sealant (PR 1720F) to the mating faces of the flange and fuselage skin in accordance with 20-22-12.

(5) Position the pipe, inserting the forward end into the convoluted sleeve (Detail Y).

NOTE: The gap between the pipe ends is approximately 1.25 in (31.75 mm).

(6) Position the flange of the outlet pipe on the fuselage skin, together with the split nut-plate ring, and insert the countersunk-head bolts (Detail Y). Ensure that the gap between the split nut-plate ring and outlet pipe is not less than 0.030 in (0.762 mm). Torque-tighten the bolts, in a diametrical sequence, to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(7) Ensure that a bead of sealant is evident between the inside edge of the flange and skin. The bead may be finished flush by using filler in accordance with 20-22-11.

(8) Secure the two backing angle and nut-strip assemblies to the structure near F96 with the bolts and washers; torque-tighten the bolts to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(9) Secure the pipe to the bracket with the bolts, spacers and nuts; insert the bolts from within the bore of the outlet pipe and ensure that each bolt and spacer is refitted in the position noted during removal; torque-tighten the nuts to between 120 and 140 lbf in (1.356 and 1.582 mdaN).

NOTE: If new spacers are to be fitted, each gap must be measured between the pipe and bracket, and the thickness of the spacers adjusted to fit the gaps within ±0.002 in (±0.05 mm). The spacers must then be cadmium-plated (Ref. 20-24-29). Bolts of the correct grip-length must be used when the spacers are being fitted.

(10) Position the double worm-drive clips on the convoluted sleeve with the worm-drives directly below and above the pipe; torque-tighten the worm drives equally to between 14 and 18 lbf in (0.158 and 0.203 mdaN) and wire-lock them in accordance with 20-21-13.

(11) Reposition the bonding clip and determine the quantity and thickness of the spacing washers to be fitted between the lugs, as detailed in Table 402 (Ref. Fig. 402). Connect the bonding lead, in accordance with 20-27-11, using the bolt, washer(s) and nut; torque-tighten the nut to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(12) Coat all bolts and nuts, securing pipe attachments, with Viton sealant PR 1720SM, in accordance with 20-22-19.

F. Conclusion

(1) Check that the electrical bonding between the pipes and between the pipe and bonding point is in accordance with 20-27-11.

(2) Carry out a Leakage Test as detailed in 28-31-32, Adjustment/Test.

(3) Ensure that all tools, equipment, etc., have been removed from the tail cone.

(4) Remove the locking sleeve from the tail gear jack.

(5) Remove the safety clips and reset the circuit breakers previously tripped (Ref. para.2.B.(4)).

(6) Remove the placards from the fuel management and refuel panels.

DUMP SYSTEM - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The dump (jettison) system comprises four collector tank jettison valves and two master jettison valves (LH and RH), connected to jettison pipes in the tailcone. Used in conjunction with other system pipes and components, the jettison system provides the means to dump fuel overboard from any fuel tank.

The following test procedures are based on the assumption that the systems associated with the jettison system are fully serviceable, i.e., Engine Feed System (Ref. 28-21-00, Adjustment/Test), Main Transfer System (Ref. 28-22-00, Adjustment/Test) and Trim Transfer System (Ref. 28-23-00, Adjustment/Test).

This topic comprises an Operational Test of the valves in the system, and an Auto Shut-off Functional Test. Auto Shut-off is provided to ensure that fuel jettison from a collector tank is automatically stopped when an underfull level in the tank is reached.

Leakage and Flow Tests applicable to the collector tank jettison valves are detailed in 28-31-11, Adjustment/Test.

Procedures for Leakage and Flow Tests of the master jettison valves, including a leakage test of the jettison pipes in the tailcone, are detailed in 28-31-32, Adjustment/Test.

Controls and indicators for the jettison system are on the fuel management panel at the third crew member's station.

2. Operational Test

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Check the collector tank jettison valve in each collector tank (1, 2, 3 and 4) in turn, as follows:-

(a) On the fuel management panel, set the switch for the appropriate valve to "OPEN" and check that the associated magnetic indicator displays diagonal stripes and then bar-in-line within 3 s of the operation of the switch.

(b) Set the switch to "SHUT" and check that the associated magnetic indicator displays diagonal stripes and then bar-across-line within 3 s of the operation of the switch.

WARNING: ALL FUEL PUMP SWITCHES MUST BE IN THE "OFF" POSITION WHEN THE MASTER JETTISON VALVES ARE OPENED.

WHEN THE MASTER JETTISON VALVES ARE BEING CLOSED, THE CORRECT "VALVE CLOSED" INDICATIONS MUST BE OBSERVED.

(2) Check the LH and RH master jettison valves in turn, as follows:-

(a) On the fuel management panel, set the switch for the appropriate valve to "OPEN" and check that the associated magnetic indicator displays diagonal stripes and then bar-in-line within 3 s of the operation of the switch.

(b) Set the switch to "SHUT" and check that the associated magnetic indicator displays diagonal stripes and then bar-across-line within 3 s of the operation of the switch.

(c) Set the switch to "OFF". Check that the associated indicator display remains bar-across-line.

R After SB 28-020 For A/C 001-004,

R (d) Reset the switch to "OPEN" and check
R that the associated magnetic indicator
R displays the correct indications.

R (e) Set the switch to "OFF" and check that

R the magnetic indicator displays diagonal
R stripes and then bar-across-line within
R 3 s of the operation of the switch.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Auto Shut-off Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Stopwatch	-
Circuit breaker safety clips	-

B. Prepare

(1) Ensure, by reference to the aircraft attitude indicator (Ref. 28-11-00, Description and Operation), that the aircraft is laterally level (0 deg roll) and between 5 min nose-down and 1 deg 55 min nose-up pitch. Reposition the aircraft if necessary.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Ensure that the fuel quantity in the collector tanks is above the underfull level (80 per cent) and that the U/FULL captions are not illuminated.

NOTE: The underfull level is approximately 3,350 kg for tanks 1 and 4 or 3,650 kg for tanks 2 and 3 at fuel specific gravity 0.80.

(4) Ensure that tanks 5, 6, 7 and 8 each have at least 2,000 kg capacity available to recieve fuel transferred from the collector tanks.

(5) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing) and the refuel control panel access door is closed.

(6) Ensure that the MASTER JETTISON VALVES switches are

in the OFF position and the associated magnetic indicators display bar-across-line.

(7) Ensure that the tail landing gear is lowered.

(8) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6

(9) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(10) Enter the tail wheel bay and check that the mechanical indicators on the master jettison valves are at position S.

(11) Disconnect the electrical connector from each valve. Fit suitable covers and stow the connectors. Fit a suitable cover to the valve fixed connector.

(12) At the third crew member's station, panel 6-214, press the LIGHTS CTR switch to "TEST" and check that all captions on the fuel management panel are illuminated. Release the switch.

(13) Set the LH MASTER JETTISON VALVE switch to "OPEN".

(14) Set tanks 5 and 6 STANDBY INLET VALVE switches to "OPEN".

(15) Set tanks 1 and 2 collector tank jettison valve switches to "OPEN".

C. Test

(1) Set tanks 1 and 2 standby ENGINE FEED PUMPS switches to "ON".

(2) Check that tanks 1 and 2 U/FULL captions are illuminated when the underfull level is reached

and that, after a time delay of between 15 and 20 s, the magnetic indicators for tanks 1 and 2 collector tank jettison valves display bar-across-line.

(3) Set the LH MASTER JETTISON VALVE switch to "SHUT"; check that tanks 1 and 2 collector tank jettison valves re-open, allowing fuel to be pumped out of these tanks after the underfull level is reached.

(4) Set tanks 1 and 2 collector tank jettison valve switches to "SHUT".

(5) Set tanks 1 and 2 standby ENGINE FEED PUMPS switches to "OFF".

(6) Set tanks 5 and 6 STANDBY INLET VALVE switches to "SHUT".

(7) Repeat the test for the RH system, substituting tanks 3 and 4 for tanks 1 and 2, tanks 7 and 8 for tanks 5 and 6, and the RH valves for the LH valves.

D. Conclusion

(1) Reconnect the electrical connectors to the master jettison valves.

(2) Remove the locking sleeve from the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(3) Reset the circuit breakers previously tripped.

(4) Carry out an Operational Test of the master jettison valves (Ref. para.2.).

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CAUTION: THE REPAIRS DETAILED IN THIS TOPIC MUST NOT BE CARRIED OUT WITH THE PIPE INSTALLED IN THE AIRCRAFT.

R B NOTE: When manufacturing new pipes, L.56 is an approved
R B alternative for AG.3 material.

1. General

The repair schemes contained in this topic apply to the light-alloy and stainless steel pipes in the tail cone, aft of frame 88.

The schemes apply not only to the straight and the curved sections of the pipes, but also to the diaphragm and the flange, and are included under the following headings:-

Simple Crack

Multiple Cracks

Pipe and Diaphragm Crack

Diaphragm Crack

Flange Cracks

There is no limitation to the number or type of repairs for a given length or area of a pipe.

2. Simple Crack (Ref. Fig. 801)

A. Equipment and Materials

DESCRIPTION	PART NO.
Radiographic flaw-detection equipment	-
Penetrant, for crack detection	-
Argon Arc welding equipment	-
Filler rods (Ref. Table 801)	-
Suitable blanks, for pipe ends, with one blank adapted for connection of a kerosine pressure supply	-
Clean kerosine	

DESCRIPTION	PART NO.
Pump, capable of pressurizing kerosine to 37 psig (2.55 bar)	-
Kimwipe tissues, or clean lint-free cloth	-

B. Prepare to Repair Simple Crack

(1) Remove the pipe from the aircraft.

C. Repair Simple Crack

(1) Depending upon whether the pipe is light-alloy or stainless steel, carry out the appropriate one of the following procedures:-

(a) Light-alloy: remove the protective treatment from the affected area.

(b) Stainless steel: if applicable, remove the protective treatment film from the affected area.

(2) Determine and mark the extent of the crack, using radiographic equipment or penetrant. If penetrant is used, thoroughly clean the crack before welding.

(3) Drill a stop hole, 0.125 in (3.20 mm) dia., at each extremity of the crack.

(4) Weld the crack, filling the stop holes, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.

D. Conclusion

(1) Check the serviceability of the weld by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

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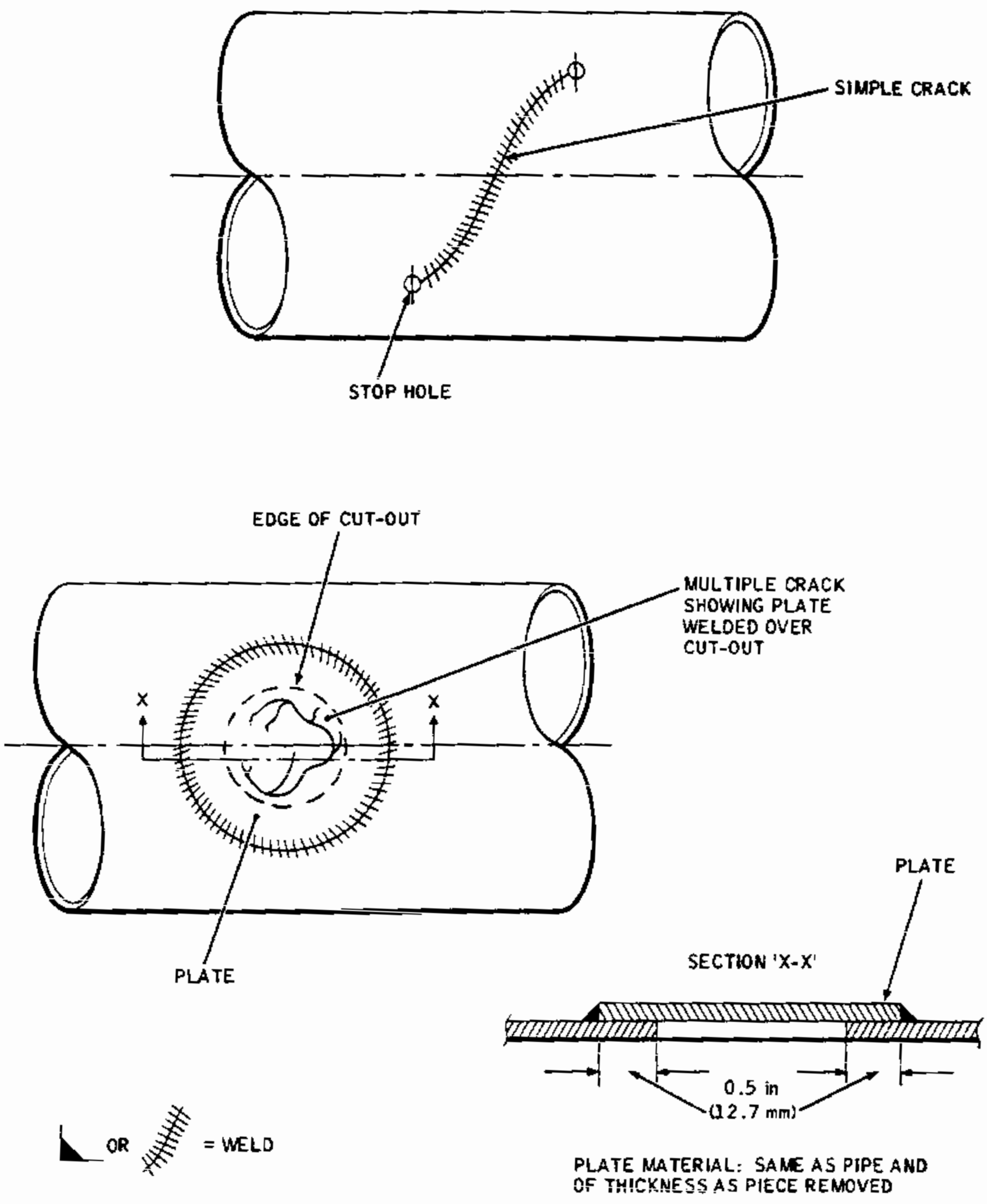

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Simple and Multiple Cracks - Repair
Figure 801

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe for a period of 15 min at the appropriate pressure, as follows:-

b1) Part Nos. E746410001 and E746364001 at 37 psig (2.55 bar).

b2) Part No. E746211001 at 25 psig (1.73 bar).

b3) All other pipes at 15 psig (1.035 bar).

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine, and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) For a light-alloy pipe, mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

PIPE PART NO.	PIPE MATERIAL	FILLER ROD
E746209001, E746365001, E746366001	L56	) BS 1453/NG6,) BS 2901/NG6, or) official) replacements
E746410001 E746364001	L67 L59	) BS 1453 or) BS 2901/G1,) G1A, G1B, G1C,) or official) replacements
E746211001	S521	BS 1453/A.8Nb, BS 1453/347S96, BS 2901.A.8Nb,

PIPE PART NO.	PIPE MATERIAL	FILLER ROD
		BS 2901/347S96, or official replacements

Pipe Material and Filler Rod
Table 801

3. Multiple Cracks (Ref. Fig. 801)

A. Equipment and Materials

(1) Refer to paragraph 2.A.

B. Prepare to Repair Multiple Cracks

(1) Remove the pipe from the aircraft.

C. Repair Multiple Cracks

(1) Depending upon whether the pipe is of light alloy or stainless steel, carry out the appropriate one of the following procedures:-

(a) Light alloy: remove the protective treatment from the affected area.

(b) Stainless steel: if applicable, remove the protective treatment film from the affected area.

(2) Determine and mark the ends of the cracks, using radiographic equipment or penetrant.

(3) Cut a hole of a regular rounded shape and of a size sufficient to remove the cracks.

(4) Make a reinforcing plate of the material and with the overlap as shown on the illustration (Ref. Fig. 801). Shape the plate to suit the contour of the pipe.

(5) Weld the plate to the pipe, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.

D. Conclusion

(1) Check the serviceability of the weld by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe for a period of 15 min at the appropriate pressure, as follows:-

b1) Part Nos. E746410001 and E746364001 at 37 psig (2.55 bar).

b2) Part No. E746211001 at 25 psig (1.73 bar).

b3) All other pipes at 15 psig (1.035 bar).

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine, and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) For a light-alloy pipe, mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

R 4. Pipe and Diaphragm Crack (Ref. Fig. 802)

NOTE: These procedures apply to the light-alloy pipe, Part No. E746364001.

A. Equipment and Materials

(1) Refer to pargraph 2.A.

B. Prepare to Repair Pipe and Diaphragm Crack

(1) Remove the pipe from the aircraft.

C. Repair Pipe and Diaphragm Crack

(1) Remove the protective treatment from the affected areas.

(2) Make a jig or fixture to suit the appropriate pipe and diaphragm.

<u>NOTE</u>: This is required to ensure that, after completion of the repair, the pipe and diaphragm are positioned exactly to their original geometry, and that the total length of the pipe has not altered.

(3) Remove the diaphragm by cutting the pipe at each side. Remove, from each cut end of the pipe, sufficient length to allow for two separate welds at each side of the diaphragm (Ref. Fig. 802).

(4) If fitted, remove the riveted reinforcing plate from the diaphragm; discard the reinforcing plate.

(5) Using Argon Arc equipment (Ref. Av.P.84/505) with the appropriate filler rod, as shown in Table 801, weld all cracks in the pipes sector, from the inside, and weld the crack in the diaphragm and, if applicable, fill the rivet holes.

(6) Make a reinforcing plate of the material and to the dimensions shown on the illustration (Ref. Fig. 802).

(7) On the diaphragm, dress the weld which will be covered by the reinforcing plate.

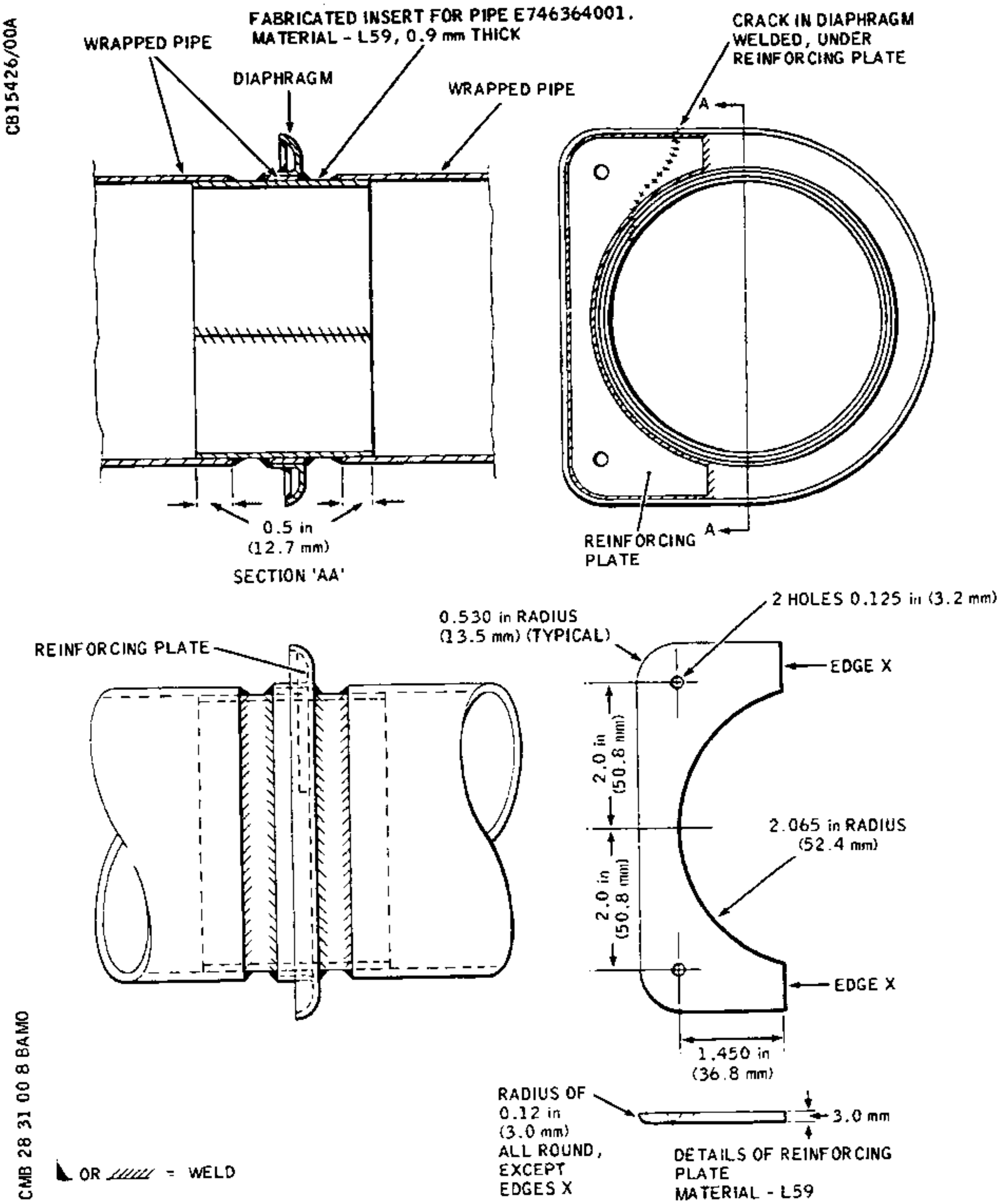
(8) Position the reinforcing plate on the diaphragm and weld the edges of the reinforcing plate (Ref. Fig. 802).

(9) Dress the weld inside the pipe.

(10) Make an insert of length equivalent to the amount of pipe removed plus 1.0 in (25.4 mm), as illustrated (Ref. Fig. 802).

(11) Deburr and clean-up the ends of the pipes and the insert.

(12) Place the diaphragm on the insert and position the



- Pipe and Diaphragm Crack - Repair
Figure 802

insert in the pipe ends.

(13) Place the complete assembly in the jig or fixture.

(14) Correctly position the diaphragm and insert; tack-weld the insert to the pipe, and the diaphragm to the insert.

(15) Ensure that the pipe and diaphragm are geometrically correct and then complete the welding process.

C. Conclusion

(1) Check the serviceability of the welds by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe to 37 psig (2.55 bar) for a period of 15 min.

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) Mask all areas of dry lubrication and areas of bare metal used for electrical bonding. Apply one coat of barium chromate epoxy primer to the external surface of the repaired area in accordance with 20-24-19.

5. Diaphragm Crack (Ref. Fig. 803)

NOTE: These procedures apply to a cracked diaphragm on the light-alloy pipe Part No. E746364001. If the pipe also is cracked, the repair procedure detailed in paragraph 4. is applicable.

A. Equipment and Materials

DESCRIPTION	PART NO.
Radiographic flaw-detection equipment	-
Penetrant, for crack detection	-
Magnetic flaw-detection equipment	-
Argon Arc welding equipment	-
Filler rods (Ref. Table 801)	-
Cadmium-plating equipment	-
R R Cleaning solvent (Ref. 20-30-00, No.473)	-
Bristle brush (soft)	-
Cooling agent (-40 deg C)	-
Kimwipe tissues, or clean lint-free cloth	-

B. Prepare to Repair Diaphragm Crack

(1) Remove the pipe from the aircraft.

C. Repair Diaphragm Crack

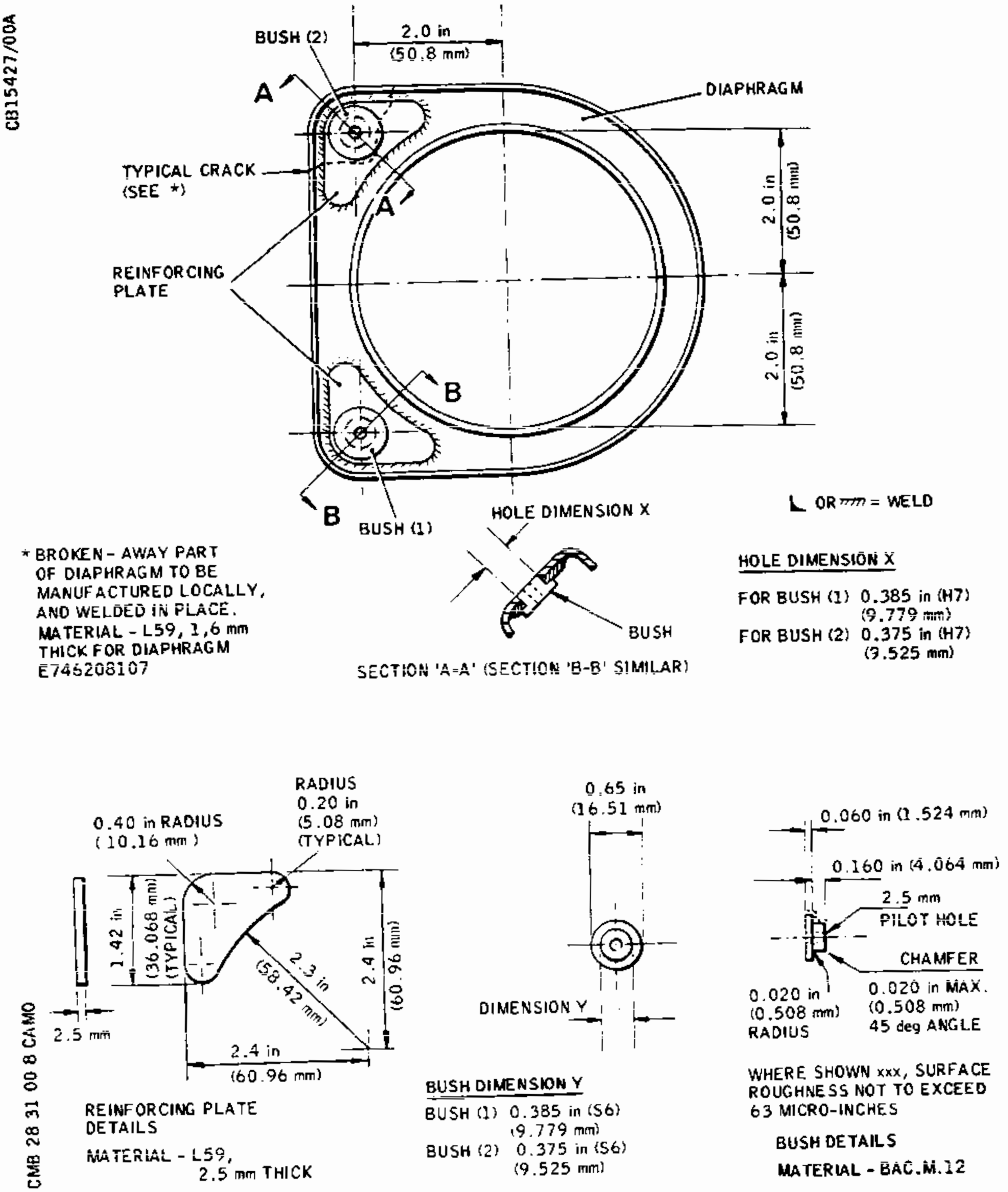
(1) If fitted, remove the riveted reinforcing plate from the diaphragm; discard the reinforcing plate.

(2) Remove the protective treatment from the affected area.

NOTE: If the corner of the diaphragm is broken away, ignore operation (3) and carry out operation (4).

(3) Weld the crack in the diaphragm, using Argon Arc equipment (Ref. Av.P.84/D505) with the appropriate filler rod, as shown in Table 801.

(4) Locally, manufacture a new corner, using material as quoted in the illustration (Ref. Fig. 803).



Diaphragm Crack - Repair
Figure 803

Weld the new corner to the diaphragm.

(5) On the diaphragm, dress the weld(s) which will be covered by the reinforcing plate(s).

(6) Make the reinforcing plates of the material and to the dimensions shown on the illustration (Ref. Fig. 803).

(7) Position the reinforcing plates on the diaphragm and weld them in place.

(8) Check the serviceability of the weld(s) by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(9) Make two bushes (Ref. Fig. 803) as follows:-

NOTE: Bushes must be made to the smaller dimension Y, if practicable; this is determined by the size of the existing hole.

The pilot holes in the bushes are enlarged on assembly of the pipe to the aircraft.

(a) Obtain sufficient material, BAC.M.12; this is fully heat-treated (solution-treated and pre-cipitated).

(b) Machine, or grind, to the sizes quoted on the illustration.

(c) If the bushes were machined, no stress-relieving procedure is necessary. If the bushes were ground, stress-relieve at a temperature of between 190 to 210 deg C for 1 h.

(d) Carry out the magnetic flaw-detection process.

(e) Carry out the cadmium-plating process.

(10) Through the diaphragm and reinforcing plates, and on the original centres, drill and ream the holes, dimension X (Ref. Fig. 803), to accommodate the bush (dimension Y), as determined in operation (9).

(11) Mask all areas of dry lubrication, areas of bare metal used for electrical bonding, and the previously reamed holes. Apply one coat of barium chromate epoxy

primer to the external surface of the repaired area in accordance with 20-24-19.

(12) Clean the bushes, as follows:-

CAUTION: DO NOT HANDLE THE BUSHES AFTER CLEANING; INSTEAD, USE A SUITABLE CLEAN TOOL.

(a) Apply cleaning solvent, BAC.M.302, using a soft bristle brush or soft cotton cloth.

(b) Remove any loosened contaminant with further applications of the solvent and cotton cloth.

(c) Ensure that the bushes are clean, and then dry them, using warm air or dry, cotton cloth. Finally wipe the bushes with clean Kimwipe tissues.

(13) Shrink and insert the bushes as follows:-

WARNING: DO NOT HANDLE THE BUSHES AFTER COOLING, OTHERWISE SKIN BURNS WILL RESULT; USE A SUITABLE CLEAN TOOL.

(a) Make a suitable fixture for insertion of the bushes.

(b) Cool the bushes to -40 deg C, or below, using any suitable means (e.g., Drikold, refrigerator, etc.); allow the bushes to 'soak' at this temperature for at least 15 min.

(c) Remove the bushes from the cooling agent and immediately fit them into the diaphragm.

(d) Allow the assembly to attain room temperature, checking that the bushes remain correctly seated.

6. Flange Cracks (Ref. Fig. 804)

NOTE: These procedures apply to the stainless steel pipe Part No. E746211001.

A. Equipment and Materials

(1) Refer to paragraph 2.A.

B. Prepare to Repair Flange Cracks

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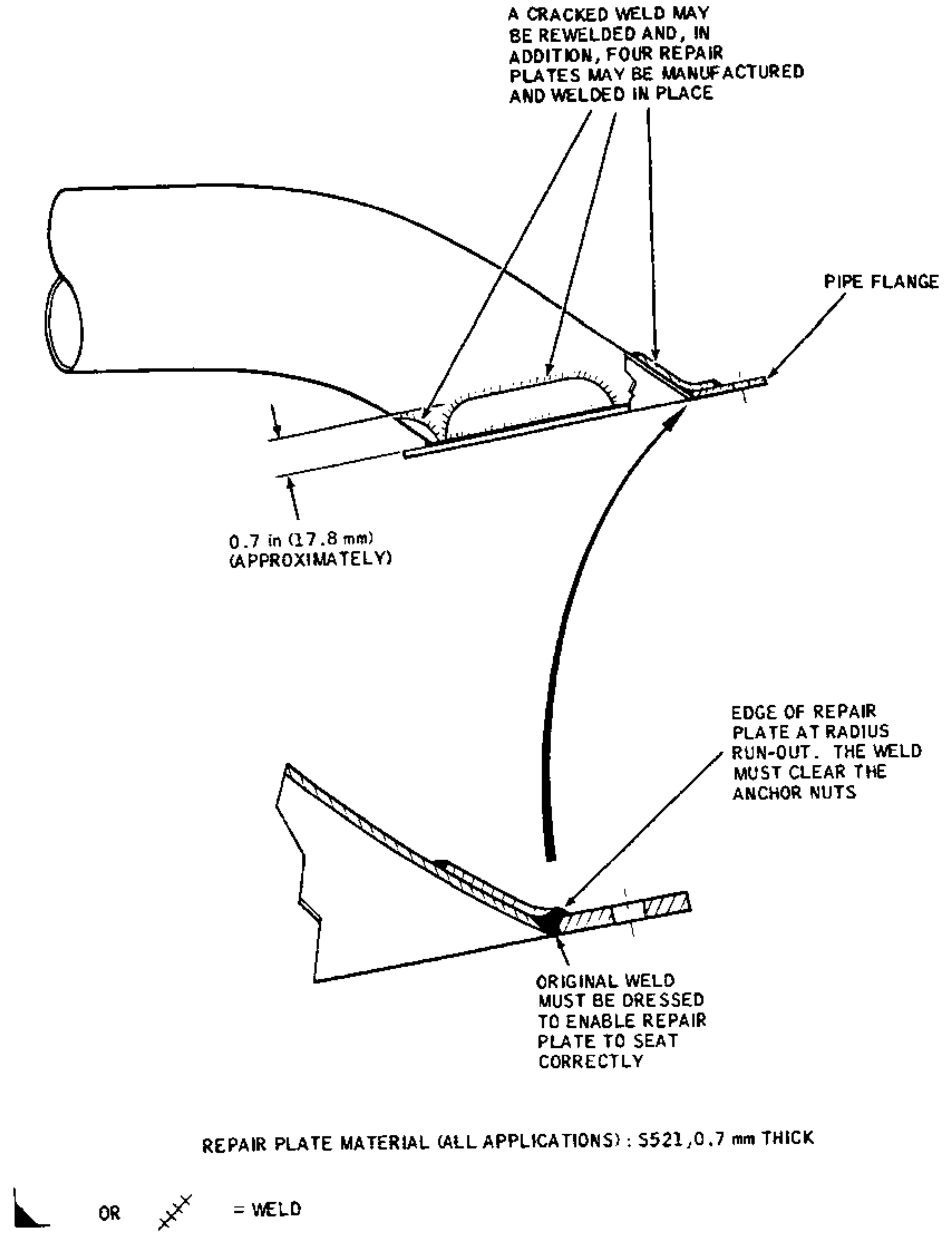

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Flange Cracks - Repair
Figure 804

(1) Remove the pipe from the aircraft.

C. Repair Flange Cracks

(1) If applicable, remove the protective treatment from the affected area.

(2) Determine the extent of the crack(s), using radiographic equipment or penetrant. If penetrant is used, throughly clean the crack(s) before welding.

NOTE: Operations (3) and (4) are alternatives, depending upon the type of damage to the flange.

(3) If the flange has not become detached from the pipe, proceed as follows:-

(a) Drill a stop hole, 0.125 in (3.2 mm) dia., at each extremity of the crack(s). Clean the area to be welded.

(b) Weld the crack(s), filling the stop holes, using Argon Arc equipment (Ref. Av.P.84/D505) with filler rod, as shown in Table 801.

(4) If the flange has become detached from the pipe, proceed as follows:-

(a) If applicable, remove the protective treatment from the affected area.

(b) Accurately position the flange on the pipe; tack-weld the flange to the pipe.

(c) Ensure that the flange is correctly positioned, and then complete the welding process.

(5) In addition to the welds made in operations (3) and (4), it is permissible to manufacture, and weld in position, four repair plates, as illustrated (Ref. Fig. 804).

D. Conclusion

(1) Check the serviceability of the welds by both of the following flaw-detection processes:-

(a) Penetrant.

(b) Radiography.

(2) Pressure-test the pipe, as follows:-

(a) Fit suitable blanks to the pipe ends, with one blank adapted for the connection of a pressure supply.

(b) Use clean kerosine and pressurize the pipe to 25 psig (1.73 bar) for a period of 15 min.

(c) Check the pipe for freedom from leakage.

(d) Release the pressure, drain the kerosine and remove the blanks.

(e) Thoroughly dry the interior of the pipe, using Kimwipe tissues or clean lint-free cloth.

(3) Mask all areas of dry lubrication, areas of bare metal used for electrical bonding, and anchor nuts, particularly the female threads.

(4) Restore the protective treatment to the face of the flange which abuts the tail cone skin, by cadmium-plating and applying one coat of barium chromate epoxy primer in accordance with 20-24-19.

COLLECTOR TANK JETTISON VALVES - REMOVAL/INSTALLATION

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four collector tank jettison valves. One is installed in each of the tanks 1, 2, 3 and 4. The valve comprises a valve element and a canister.

The valve element can be removed without draining the tank, but the tank must be drained when a canister is to be removed.

This topic comprises removal/installation procedures for a valve element, a valve motor and the canisters.

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2. Valve Element (Ref. Fig.401)

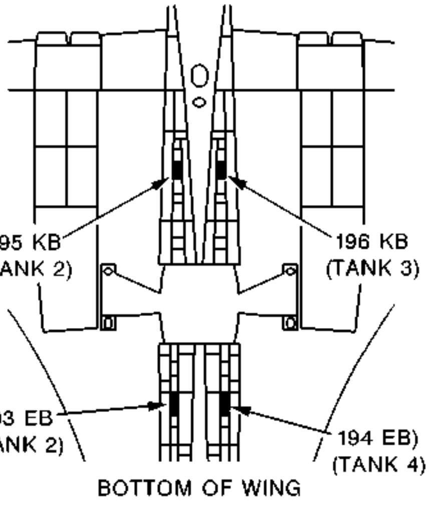
A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 10 to 14 lbf in (0.113 to 0.158 mdaN)	-
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 1 pint (0.568 l) capacity	-

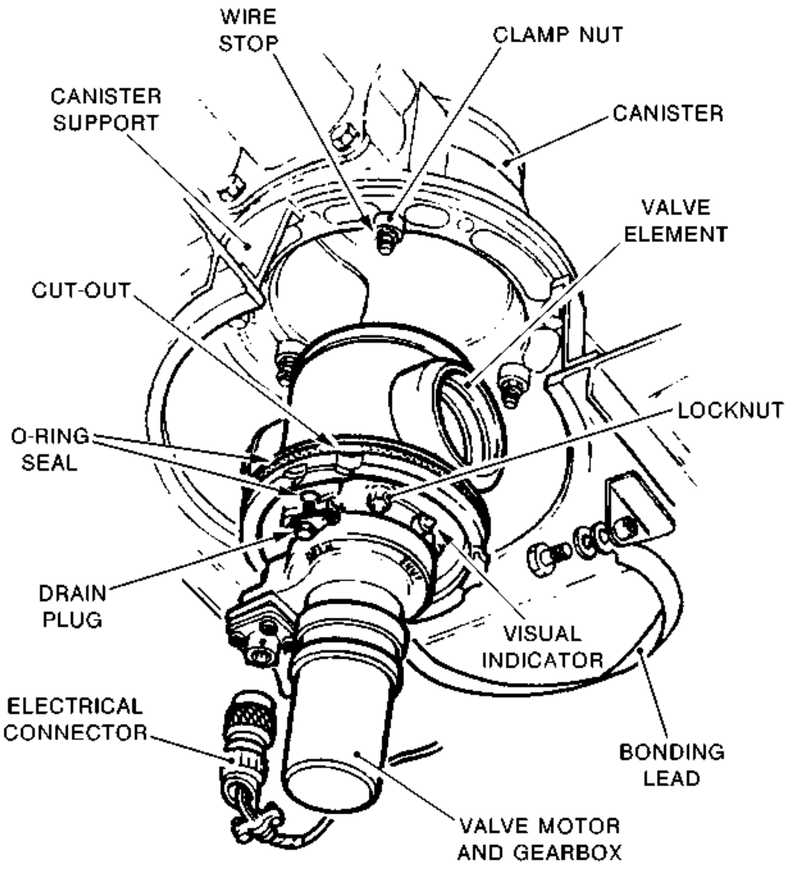
B. Prepare to Remove Valve Element

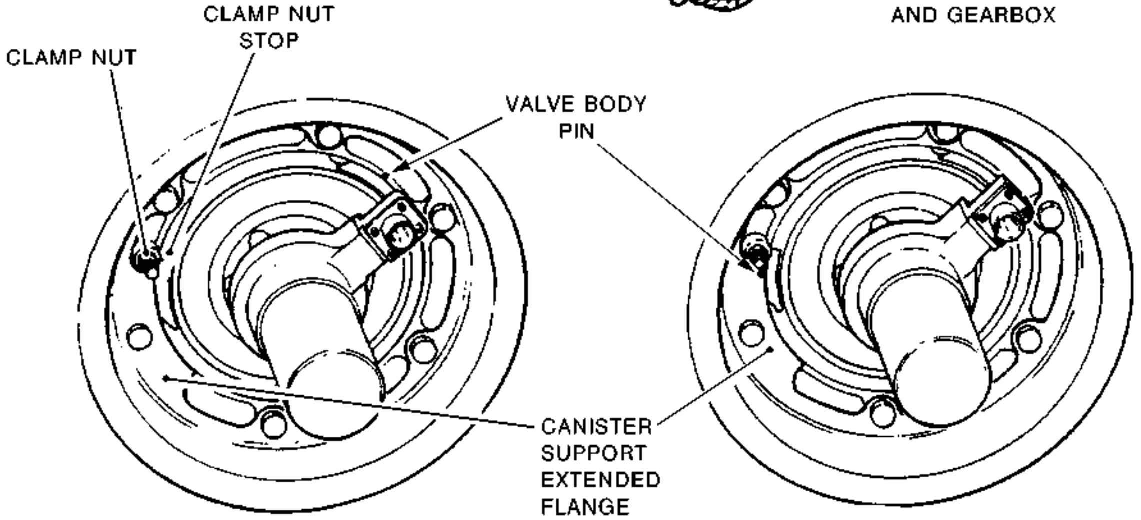
(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(2) Attach warning placards to the fuel management and refuel control panels, indicating that the position of the switches must not be changed.



TANK NO.	1	2	3	4
ELECT. IDENT.	Q147	Q148	Q149	Q150
ELECTRICAL IDENT. AND ASSOCIATED TANK NOS.				





VIEW SHOWING INSERTION OF CORRECT VALVE ELEMENT BEFORE 90 deg COUNTER-CLOCKWISE ROTATION

VIEW SHOWING INSERTION OF INCORRECT VALVE ELEMENT. NOTE THAT PIN FOULS FLANGE AND PREVENTS FULL INSERTION OF VALVE ELEMENT.

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Jettison Valve Element - Installation
Figure 401

(3) Trip the appropriate circuit breaker and fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 JET VALVE SUP	3-213	Q 131	C 7
TANK 2 JET VALVE SUP	15-216	Q 132	B 7
TANK 3 JET VALVE SUP	1-213	Q 133	L11
TANK 4 JET VALVE SUP	15-215	Q 134	D20

(4) Remove the appropriate access panel (Ref. Fig.401).

C. Remove Valve Element

(1) Remove the bolt and washer securing the bonding lead to the structure.

(2) Disconnect the electrical connector from the valve element.

CAUTION: TO PREVENT DAMAGE TO THE WIRE STOPS IN THE CLAMPING NUT STUDS, DO NOT SLACKEN THE CLAMPING NUTS MORE THAN TWO TURNS.

(3) Slacken the clamp nuts by not more than two turns.

(4) Rotate the valve element clockwise through 90 deg and align the cut-outs in the valve body with the clamp nuts.

(5) Position the container under the drain plug and remove the drain plug. Allow fuel (approximately 1 pint (0.568 l)), to drain from the valve.

(6) Pull the valve element from the canister. Refit the drain plug to the valve element.

(7) Remove and discard the O-ring seal from the valve element.

(8) Fit a suitable blank to the canister aperture.

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D. Prepare to Install Valve Element

NOTE: During installation, O-ring seals must be lubricated in accordance with 20-23-11.

(1) Remove the drain plug and fit a new O-ring seal. Refit the drain plug hand-tight only.

(2) Fit a new O-ring seal to the valve element.

(3) Remove the blank from the canister aperture.

E. Install Valve Element

(1) Comply with the electrical and fuel safety precautions.

(2) Insert the valve element into the canister. Ensure that the valve body cut-outs are aligned with the clamp nuts and push the valve element firmly and fully into the canister.

NOTE: A small pin on the periphery of the valve body ensures installation of the correct valve element. If the pin fouls an extension of the top flange in the canister support (Ref. Fig.401), an incorrect valve element is being used.

(3) Rotate the valve element counter-clockwise through 90 deg.

(4) Torque-tighten the clamp nuts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(5) Torque-tighten the drain plug to between 10 and 14 lbf in (0.113 and 0.158 mdaN).

(6) Secure the bonding lead to the structure bracket with the washer and bolt. Torque-tighten the bolt to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(7) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

(8) Check the bonding of the valve element installation in accordance with 20-27-11.

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F. Conclusion

(1) Reset the circuit breakers previously tripped.

(2) Carry out Functional, Flow and Leakage Tests of the valve element (Ref. Adjustment/Test).

(3) Remove the warning placards from the fuel management and refuel control panels.

(4) Refit the access panel.

3. Valve Motor (Ref. Fig.401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Remove the valve element (Ref. para.2.).

C. Remove Valve Motor

(1) Remove the locknuts securing the motor to the four studs on the valve body.

(2) Remove the motor from the valve body.

D. Prepare to Install Valve Motor

(1) Check that the mating faces of the valve body and motor are clean and undamaged and also the splined drives of the motor and valve body.

E. Install Valve Motor

(1) Align the master splines and locating dowel and assemble the motor to the valve body with the four locknuts.

(2) Torque-tighten the four locknuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

F. Conclusion

(1) Refit the valve element to the canister (Ref. para.2.).

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4. Valve Canister - Tank 1 or 4 (Ref. Fig.402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Container, 10 gal (45 l) capacity, for fuel spillage	-
Container, 1 gal (4.5 l) capacity, for fuel spillage	-

B. Prepare to Remove Canister - Tank 1 or 4

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(3) Defuel the associated tank (Ref. 28-25-00, Servicing).

(4) With the collector tank jettison valve left open, drain the trim transfer pipe of fuel as follows:

(a) Position the 10 gal (45 l) container at the fuel jettison outlet, to collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

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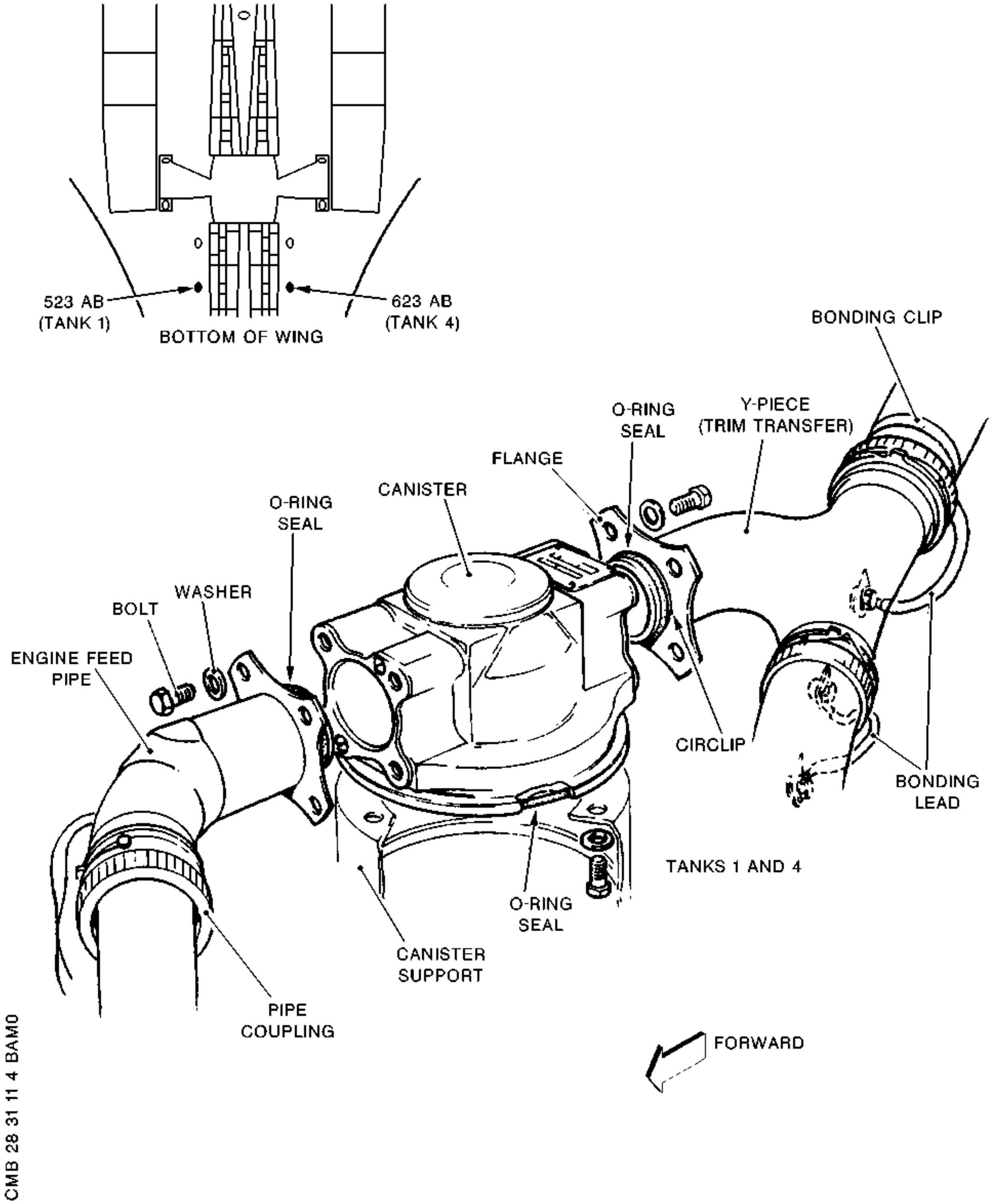

Jettison Valve Canister, Tanks 1 and 4 - Installation
Figure 402

(e) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(f) Set the collector tank jettison valve switch to "SHUT".

(g) Remove the container.

(5) Attach warning placards to the fuel management and refuel control panels, indicating that the position of the switches must not be changed.

(6) Remove the associated tank access panel (Ref. Fig.402) and prepare the tank for entry (Ref. 28-10-00, Servicing).

(7) Remove the valve element (Ref. para.2.).

C. Remove Canister - Tank 1 or 4

(1) From inside the tank, remove the bolts and washers securing the engine feed and trim transfer pipes to the canister. Note the position of the special bonding (dimpled head) bolts at each joint for subsequent installation.

(2) Disconnect the bonding lead across the engine feed pipe coupling. Disconnect the pipe coupling and remove the engine feed pipe. Remove and discard the O-ring seal at each end of the pipe.

<u>NOTE</u>: Up to a 1/2 gal (3 l) of residual fuel will drain from the engine feed pipe. Use the 1 gal (4.5 l) container to collect this fuel.

(3) Disconnect the bonding lead across the trim transfer Y-piece pipe couplings. Disconnect the pipe couplings and remove the Y-piece. Remove and discard the O-ring seals from the Y-piece.

(4) Fit suitable blanks to the open pipelines.

(5) From outside the tank, remove the bolts and washers securing the canister to the canister support. Note the position of the special bonding bolt for subsequent installation.

(6) Remove the canister from the tank, and remove and discard the canister O-ring seal.

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D. Install Canister - Tank 1 or 4

NOTE: New O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the electrical and fuel safety precautions.

(2) Fit a new O-ring seal to the base of the canister. Assemble the canister to the canister support with the bolts and washers, with the special bolt fitted to the position noted during removal. Hand-tighten the bolts.

(3) Remove the blanks from the engine feed and trim transfer pipes.

(4) Fit new O-ring seals to the engine feed and trim transfer pipes.

(5) Refit the engine feed pipe and trim transfer Y-piece to their respective pipe couplings in accordance with 20-23-21.

(6) Connect the engine feed pipe and trim transfer Y-piece flange joints to the canister with the bolts and washers. Ensure that the special bonding bolts are fitted to the positions noted during removal. Hand-tighten the bolts.

(7) Connect the bonding leads across the pipe couplings with the bolts and washers. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(8) Secure the canister to the canister support by torque-tightening the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(9) Secure the engine feed pipe and trim transfer pipe-to-canister joints by torque-tightening the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(10) Check the bonding of the installation in accordance with 20-27-11.

E. Conclusion

(1) Install the valve element (Ref. para.2.).

(2) Carry out a Leak Test - Valve Canister (Ref. Adjustment/Test).

R (3) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (4) Refit the tank access panel.

R (5) Refuel the tank (Ref. 28-25-00, Servicing).

R (6) Check that there are no fuel leaks from the base of the canister and the tank access panel.

R (7) Refit the valve element access panel (Ref. Fig.401).

R (8) Remove the warning placards from the fuel management and refuel control panels.

5. Valve Canister - Tank 2 or 3 (Ref. Fig.403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Torque spanner, 35 to 44 lbf in (0.395 to 0.497 mdaN)	-
Torque spanner, 45 to 55 lbf in (0.508 to 0.621 mdaN)	-
Torque spanner, 71 to 80 lbf in (0.802 to 0.904 mdaN)	-
Torque spanner, 60 to 72 lbf in (0.678 to 0.813 mdaN)	-
Container, 1 gal (3 l) capacity, for fuel spillage	-

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DESCRIPTION	PART NO.
Container, 10 gal (45 l) capacity, for fuel spillage	-
Container, 50 gal (227 l) capacity, for fuel spillage	-
Bonding cable, for fuel spillage container	-
Adapter, fuel overflow pipe	E925127000
Hose, 3 in (76.2 mm) ID	-
Circuit breaker safety clips	-

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B. Prepare to Remove Canister - Tank 2 or 3

(1) Make available electrical ground power as detailed in 24-41-00, Servicing.

(2) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing).

(3) Defuel the associated tank (Ref. 28-25-00, Servicing).

NOTE: As the scavenge pump returns fuel to tank 3, when draining the trim transfer pump, different draining procedures are required for each canister installation. Carry out operation (4) or (5) as applicable.

(4) Tank 2 installation: drain the trim transfer pipe as follows:

(a) Leave the collector tank jettison valve switch open.

(b) Position the 10 gal (45 l) container at the fuel jettison outlet. This will collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(c) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(d) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(e) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(f) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(g) Set the collector tank jettison valve switch to "SHUT".

(h) Remove the container.

(5) Tank 3 installation: drain the trim transfer pipe as follows:

(a) Leave the collector tank jettison valve switch open.

(b) Remove the bung from the fuel overflow pipe adapter and fit the hose to the adapter.

(c) Position the 50 gal (227 l) container under the overflow relief valve (ORV) outlet. Electrically bond the container to the aircraft.

(d) Fit the adapter to the ORV outlet and position the hose in the container.

(e) Inhibit the operation of the scavenge pump by tripping the circuit breakers. Fit circuit breaker safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
SCAVENGE PUMP SUP	14-216	Q 491	E 4
SCAVENGE PUMP CONT & IND	15-216	Q 493	C 6

(f) Position the 10 gal (45 l) container at the fuel jettison outlet.

(g) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(h) Set the TRIM PIPE DRAIN switch to "OPEN".

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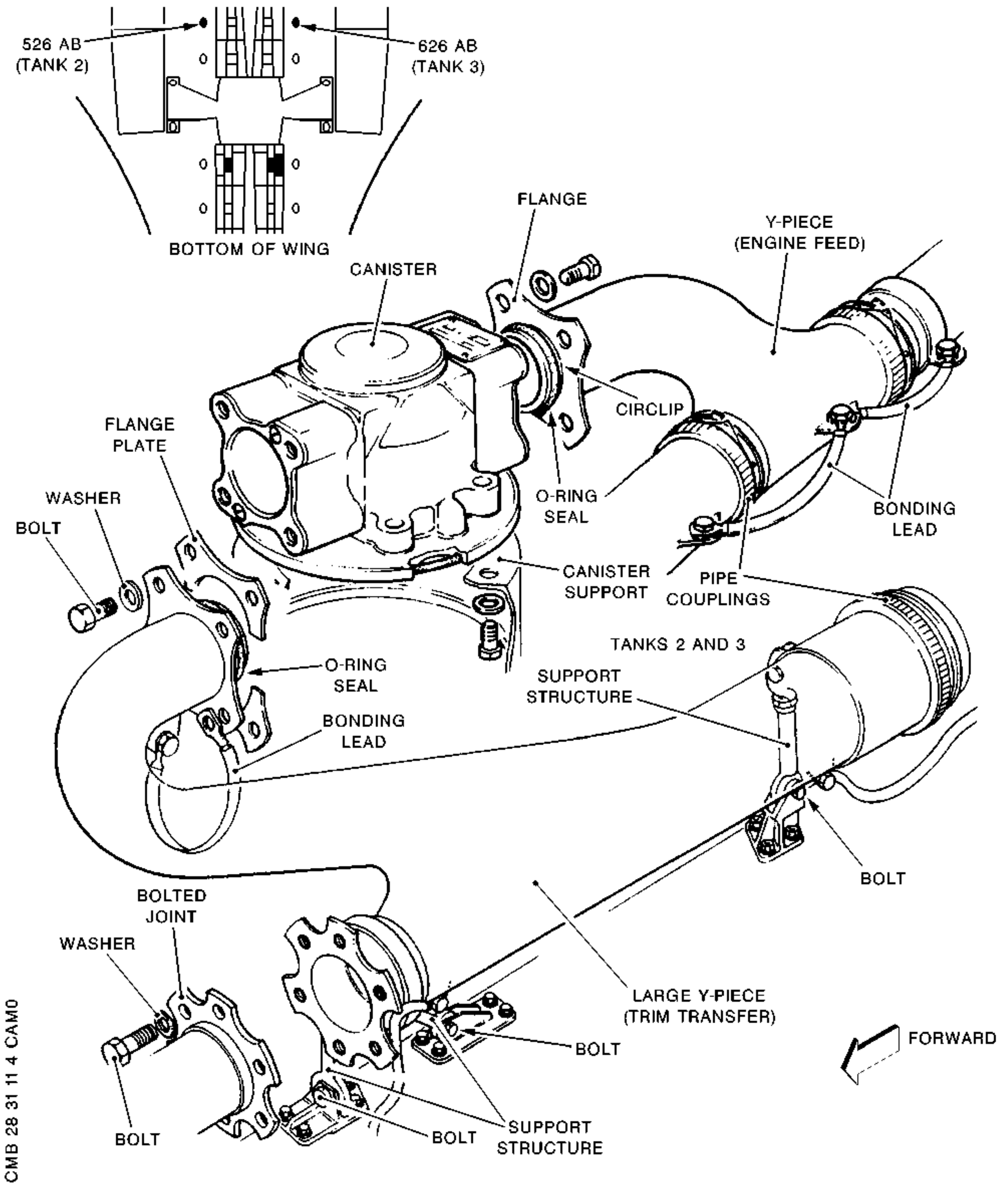

Jettison Valve Canister, Tanks 2 and 3 - Installation
Figure 403

NOTE: Fuel draining into the scavenge tank will activate the ORV sensors, causing the ORV to open and allow fuel to drain from the scavenge tank into the container.

(j) When fuel starts to drain into the container, keep the ORV open, by tripping the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q271, on panel 1-213, map ref. K15.

(k) Wait until the fuel draining stops, then set the TRIM PIPE DRAIN switch to "SHUT".

(l) Set the JETTISON MASTER VALVES switches to "SHUT", wait until the associated magnetic indicators display bar-across-line, then set the switches to "OFF".

(m) Set the collector tank jettison valve switch to "SHUT".

(n) Reset the OVERFLOW RELIEF VALVE SUP & IND circuit breaker Q721, on panel 1-213, map ref. K15. Check that the ORV closes.

WARNING: TO PREVENT INADVERTENT OPERATION OF THE SCAVENGE PUMP, DO NOT RESET THE SCAVENGE PUMP CIRCUIT BREAKERS.

(p) Remove the containers.

(6) Attach warning placards to the fuel management and refuel control panels, indicating that the position of the switches must not be changed.

(7) Remove the associated tank access panel (Ref. Fig.402) and prepare the tank for entry (Ref. 28-10-00, Servicing).

(8) Remove the valve element (Ref. para.2.).

(9) As required, remove tank bracing struts (Ref. 57-10-00) to gain access to the canister.

C. Remove Canister - Tank 2 or 3

(1) From inside the tank remove the bolts and washers securing the engine feed and trim transfer pipes to the canister. Note the position of the special bolts (dimpled head) and bonding lead at each joint for subsequent installation.

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(2) Disconnect the bonding lead across the engine feed pipe couplings. Disconnect the pipe couplings and remove the engine feed pipe. Remove and discard the O-ring seals from the pipe.

NOTE: Up to a 1/2 gal (3 l) of residual fuel will drain from the engine feed pipe. Use the 1 gal (4.5 l) container to collect this fuel.

(3) Disconnect the bonding lead across the trim transfer pipe couplings. Disconnect the pipe coupling and bolted joint.

(4) Remove the three bolts and washers securing the trim transfer pipe support struts to the tank floor brackets.

(5) Remove the trim transfer pipe and split flange plates. Remove and discard all O-ring seals from the pipe.

(6) Fit suitable blanks to the open pipelines.

(7) From outside the tank, remove the bolts and washers securing the canister to the canister support. Note the position of the special bonding bolt for subsequent installation.

(8) Remove the canister from the tank and remove and discard the canister O-ring seal.

D. Install Canister - Tank 2 or 3

NOTE: New O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the electrical and fuel safety precautions.

(2) Fit a new O-ring seal to the base of the canister. Assemble the canister to the canister support with the bolts and washers, with the special bolt fitted to the position noted during removal. Hand-tighten the bolts.

(3) Remove the blanks from the engine feed and trim transfer pipes.

(4) Fit new O-ring seals to the engine feed and trim transfer pipes.

(5) Refit the engine feed and trim transfer pipes to their respective pipe couplings, in accordance with 20-23-21. During installation of the trim transfer pipe, align the pipe support struts with the floor brackets.

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(6) Fit the bolts and washers to the bolted joint. Hand-tighten the bolts.

(7) Fit the trim transfer pipe to the canister joint with the split flange plate (Ref. Fig.403), the bolts and washers and the bonding lead fitted under the head of the bolt at the position noted during removal. Hand-tighten the bolts.

(8) Fit the engine feed pipe to the canister joint with the bolts and washers. Ensure that the special bonding bolt is fitted to its position noted during removal. Hand-tighten the bolts.

(9) Connect the bonding leads across the pipe couplings with the bolts and washers. Torque-tighten the bolts to between 35 and 44 lbf in (0.395 and 0.497 mdaN).

(10) Secure the canister to the canister support by torque-tightening the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(11) Secure the engine feed and trim transfer pipes to the canister joints by torque-tightening the bolts to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(12) Torque-tighten the bolts in the bolted flange to between 45 and 55 lbf in (0.508 and 0.621 mdaN).

(13) Secure the trim transfer pipe support struts to the tank floor brackets with the three bolts and washers. Torque-tighten the bolts to between 71 and 80 lbf in (0.802 and 0.904 mdaN).

(14) Check the bonding of the installation in accordance with 20-27-11.

E. Conclusion

(1) Install the valve element (Ref. para.2.).

(2) Carry out a Leak Test - Valve Canister (Ref. Adjustment/Test).

(3) Refit the tank bracing struts previously removed (Ref. 57-10-00).

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R (4) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (5) Refit the tank access panel.

R (6) If the scavenge pump circuit breakers were tripped in operation 5.B., remove the safety clips and reset the circuit breakers.

R (7) Refuel the tank (Ref. 28-25-00, Servicing).

R (8) Check that there are no fuel leaks from the base of the canister and the tank access panel.

R (9) Refit the valve element access panel.

R (10) Remove the warning placards from the fuel management and refuel control panels.

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COLLECTOR TANK JETTISON VALVES - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

There are four collector tank jettison valves, one in each of the collector tanks (1, 2, 3 and 4). The control switches are located on the fuel management panel and each has two settings, OPEN and SHUT. The four switches are normally set to SHUT and are guarded by a common guard.

The following procedures comprise a Functional Test and a Leakage Test of the valve element, a Leakage Test of the valve canister and a Flow Test of the valve. Operational and System Tests are not necessary in this application.

2. Functional Test - Valve Element

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Remove the appropriate access panel (Ref. Removal/Installation).

B. Test

(1) On the fuel management panel, set the switch for the appropriate collector tank jettison valve to "OPEN". Check that -

R (a) the valve opens within 3 s of the operation
R of the switch,

(b) the associated magnetic indicator on the
R fuel management panel displays diagonal
R stripes then bar-in-line and

(c) the mechanical indicator on the valve indicates OPEN.

(2) Set the switch to "SHUT" and check that -

R (a) the valve shuts within 3 s of the operation
R of the switch,

(b) the associated magnetic indicator displays
R diagonal stripes then bar-across-line and

(c) the mechanical indicator on the valve indicates SHUT.

C. Conclusion

(1) Fit the access panel.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test - Valve Element

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Remove the appropriate access panel (Ref. Removal/Installation).

B. Test

(1) Ensure that the appropriate collector tank has a minimum content of 1,000 kg of fuel to make the test.

(2) On the fuel management panel, proceed as follows:-

(a) Set the switch for the appropriate collector tank jettison valve to "OPEN" and check that the associated magnetic indicator displays
R diagonal stripes then bar-in-line.

(b) Lift the guard and set the switch for the appropriate LP isolation valve to "SHUT 1". Check that the associated magnetic indicator displays bar-across-line.

(c) Set the switch for the appropriate collector

tank 2nd standby engine feed pump to "ON" and check that the associated caption is
R extinguished after 3 s, indicating a correct build-up of pump pressure.

(3) Check that there is no external leakage of fuel from the valve element.

C. Conclusion

(1) On the fuel management panel, proceed as follows:-

(a) Set the switch for the appropriate collector tank 2nd standby engine feed pump to "OFF".

(b) Set the switch for the appropriate collector tank jettison valve to "SHUT" and check that the associated magnetic indicator displays
R diagonal stripes then bar-across-line.

(c) Set the switch for the appropriate LP isolation valve to "OPEN" and check that the associated magnetic indicator displays bar-in-line. Refit the guard.

(2) Fit the access panel.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Leakage Test - Valve Canister

A. Equipment and Materials

DESCRIPTION	PART NO.
Blanking tool, for fuel accumulator	E925073030
Adapter	-
Receptacle, 5 gal (23 l)	-
Bonding lead	-

B. Prepare

(1) Ensure that all fuel management panel switches are

at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Drain the appropriate collector tank (Ref. 28-25-00, Servicing).

WARNING: OBSERVE THE FUEL TANK SERVICING PROCEDURES DETAILED IN 28-10-00, SERVICING.

(4) Remove the tank access panel (Ref. Removal/ Installation).

(5) On the wing top surface, fit the blanking tool to the fuel accumulator (Ref. 28-21-11) as follows:-

(a) Remove the four screws which secure a plate to the top of the accumulator; remove the plate.

(b) Fit a new O-ring seal, lubricated in accordance with 20-23-11, to the blanking tool spindle and fit the tool to the accumulator, using the four screws removed in operation (a).

(c) Fit an adapter, with a bleed facility, to the tool.

(6) At the fuel management panel, carry out the following checks:-

(a) Check, by reference to the fuel quantity indicators, that tank 9 (or tank 10) contains fuel. Transfer fuel or refuel (Ref. 12-11-28) if necessary.

R (b) Check that all INLET VALVE O/RIDE switches, STANDBY INLET VALVES switches and the TRIM PIPE DRAIN valves switch are set to SHUT and that their associated indicators display accordingly.

C. Test

(1) At the fuel management panel, proceed as follows:-

(a) Set the LP VALVE switch of the tank

containing the canister to "SHUT 1" and check that the associated indicator displays bar-across-line.

(b) Set the jettison valve switch of the tank containing the canister to "OPEN" and check that the associated indicator displays
R diagonal stripes then bar-in-line.

(c) Set the appropriate PUMP switch (LH or RH) for tank 9 (or tank 10) to "ON" and check that the LOW PRESS caption is illuminated and then extinguished after 3 s as pump pressure builds up.

NOTE: The tank associated with the PUMP switch must contain fuel. The LH PUMP switch is associated with the LH system (tanks 1 and 2) and the RH PUMP switch is associated with the RH system (tanks 3 and 4).

(2) On the wing top surface, bleed the system of air at the adapter on the fuel accumulator blanking tool and then close the bleed facility.

(3) Maintain the pump pressure and enter the tank. Check that there is no leakage from the pipe joints over a minimum period of 15 min.

(4) Set the collector tank jettison valve switch to "SHUT" and check that the associated indicator
R displays diagonal stripes then bar-across-line.

(5) Set the PUMP switch to "OFF".

D. Conclusion

(1) On the top surface of the wing, slowly release any residual pressure, using the bleed facility on the blanking tool. Position a 5 gal (23 l) receptacle, electrically bonded to the aircraft, to collect any fuel discharge.

(2) Remove the blanking tool and secure the plate to the top of the accumulator, using the four screws.

(3) Refit the tank access panel.

(4) Set all the switches at the fuel management panel

to their normal ground settings (Ref. 28-00-00, Servicing).

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

5. <u>Flow Test - Valve</u>

A. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground settings (Ref. 28-00-00, Servicing).

(2) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Check, by reference to the fuel quantity indicators, that the appropriate collector tank contains at least 2,000 kg of fuel. Check that the associated main transfer tank is less than 60 per cent full.

(2) On the fuel management panel:

(a) Set the switch for the appropriate collector tank jettison valve to "OPEN" and check that the associated magnetic indicator displays
R diagonal stripes then bar-in-line.

(b) Set the switch for the associated main transfer tank inlet valve to "OPEN" and check that the associated magnetic indicator
R displays diagonal stripes then bar-in-line.

(c) Ensure that all other tank inlet and cross-feed valves are closed and the associated magnetic indicators display accordingly.

(d) Set the switch for the appropriate collector tank 2nd standby engine feed pump to "ON" and check that the associated caption is
R extinguished after 3 s, indicating a correct build-up of pump pressure.

(3) Check for fuel transfer from the collector tank to the main transfer tank. The transfer rate must not be less than 380 kg/min.

C. Conclusion

(1) On the fuel management panel:

(a) Set the switch for the appropriate collector tank 2nd standby engine feed pump to "OFF".

(b) Set the switch for the appropriate collector tank jettison valve to "SHUT" and check that the associated magnetic indicator displays
R diagonal stripes then bar-across-line.

(c) Set the switch for the appropriate LP isolation valve to "OPEN" and check that the associated magnetic indicator displays bar-in-line. Refit the guard.

(d) Ensure that the main transfer tank inlet valve switch is set to "SHUT" and that the associated magnetic indicator displays
R diagonal stripes then bar-across-line.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

MASTER JETTISON VALVES - REMOVAL/INSTALLATION

1. General

Two master jettison valves are installed on the rear face of the tank 11 rear bulkhead. Access to the valves is gained via the tail wheel doors in the tail cone.

An angled coupling and spool arrangement in the piping enables the valve to be removed without dismantling the piping.

This topic includes the removal/installation of the complete valve and, separately, the valve motor.

2. Master Jettison Valve (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-
Torque spanner, 25 to 30 lbf in (0.282 to 0.339 mdaN)	-
Torque spanner, 31 to 40 lbf in (0.350 to 0.452 mdaN)	-
Container, 10 gal (45 l) capacity, for fuel spillage	-

B. Prepare to Remove Master Jettison Valve

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing) and that the refuelling control access panel is closed.

NOTE: (3) and (4) are alternative operations.

(3) If a master jettison valve has not failed shut, drain the trim transfer pipe of fuel as follows:-

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(a) Position the 10 gal (45 l) container at the fuel jettison outlet.

NOTE: This is to collect a small amount of fuel that will drain from the outlet when the master jettison valves are opened.

(b) At the fuel management panel, set the JETTISON MASTER VALVES switches to "OPEN".

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge tank.

(d) Wait until the scavenge pump indicator displays OFF, then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set the JETTISON MASTER VALVES switches to "SHUT". Wait until the associated indicators display bar-across-line, then set the switches to "OFF".

(f) Remove the container from the jettison outlet.

(4) If a master jettison valve has failed shut, drain the trim transfer pipe of fuel as follows:-

(a) Ensure that tank 11 fuel quantity is less than 50 per cent. Transfer fuel or defuel (Ref. 28-25-00, Servicing) as necessary.

(b) Set tank 11 INLET VALVES OVERRIDE switches to "OPEN". Ensure that the associated indicator displays bar-in-line.

(c) Set the TRIM PIPE DRAIN switch to "OPEN".

NOTE: The SCAVENGE PUMP indicator will display ON as fuel drains into the scavenge pump.

(d) Wait until the scavenge pump indicator displays OFF. Then set the TRIM PIPE DRAIN switch to "SHUT".

(e) Set tank 11 INLET VALVES OVERRIDE switches to "SHUT". Wait until the associated indicators display bar-across-line, then set the switches to "OFF".

(5) Attach placards to the fuel management and refuel control panels, warning that the position of the switches must not be changed.

(6) Ensure that the tail landing gear is lowered.

(7) Trip the following circuit breakers and fit safety clips.

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K17
LH JET MASTER VALVE SUP & IND	3-215	1Q302	A7
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

**ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K18
LH JET MASTER VALVE SUP & IND	3-213	1Q302	A7
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC POSN IND	1-213	G51	N16

(8) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove Master Jettison Valve

(1) Disconnect the electrical connector from the valve.

(2) Remove the bonding lead attachments from the bonding lug at the valve motor.

(3) Slacken the coupling nuts at each end of the spool.

(4) Remove the locking wire and remove the three bolts and washers securing the valve to the angled coupling and bulkhead mounting.

(5) Hold the valve against the bulkhead mounting and push the angled coupling rearward as far as possible.

NOTE: The angled coupling and spool-to-pipe joints will slide into each other.

(6) Carefully ease the valve from the bulkhead mounting.

(7) Remove the O-ring seals from the valve; discard the seals.

(8) Fit suitable blanks to the angled coupling and bulkhead adapter.

D. Install Master Jettison Valve

NOTE: O-ring seals must be lubricated in accordance with 20-23-11 before installation.

(1) Comply with the fuel and electrical safety precautions.

(2) Fit new O-ring seals to the valve.

(3) Remove the blanks from the angled coupling and bulkhead mounting. Check that the sliding and

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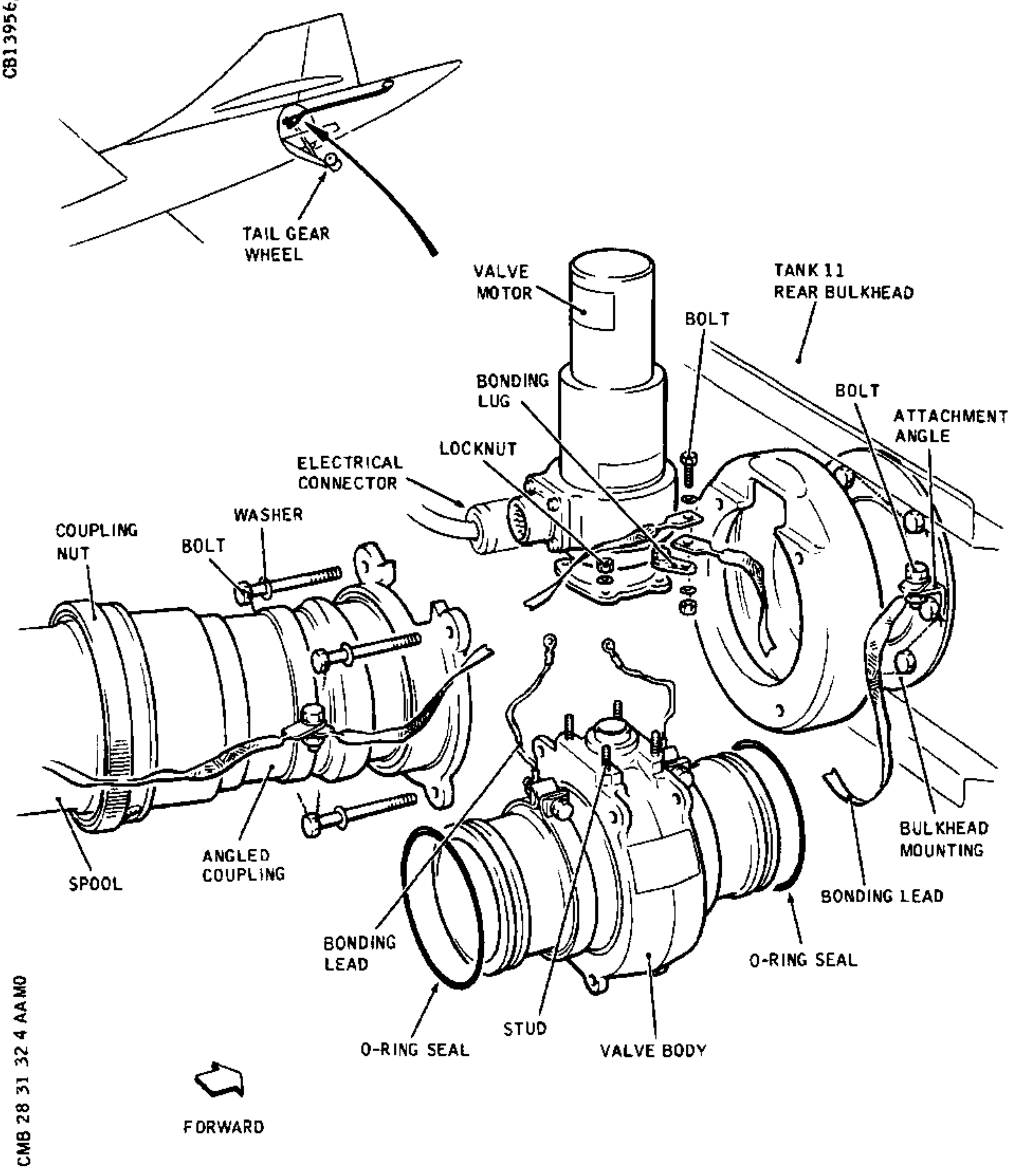

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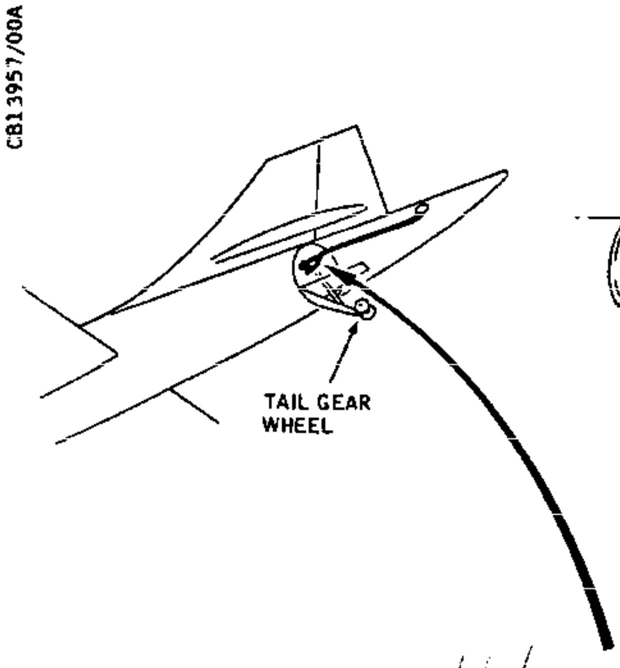
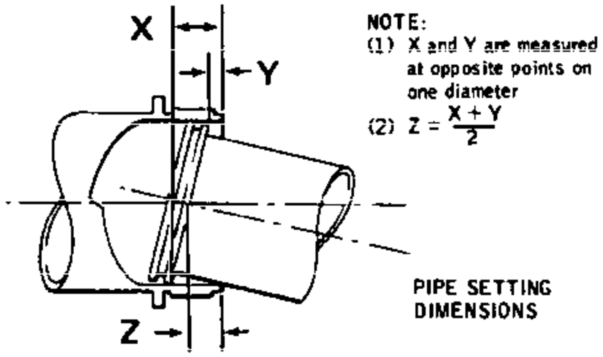
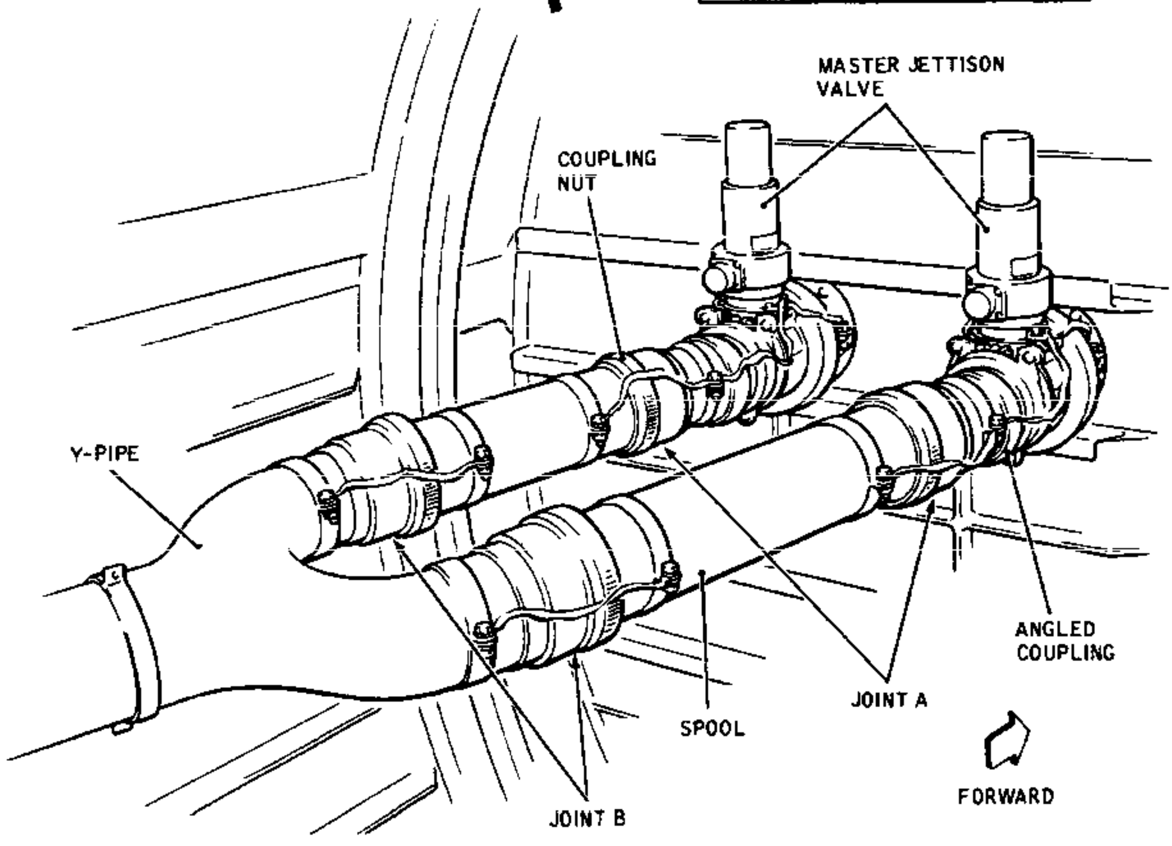
\- Master Jettison Valve - Installation
Figure 401





JOINT	INSERTION DIMENSION Z	
	in	mm
A	0.2 nom	5.1
B	0.2 (+ 0.2 - 0.1)	5.1 (+ 5.1 - 2.5)



\- Spool Joint - Installation
Figure 402

mating surfaces are clean and undamaged.

(4) Fit the valve into the bulkhead mounting and align the bolt holes.

(5) Draw the angled coupling and spool to the valve and align the bolt holes.

(6) Secure the valve with the three bolts and washers. Torque-tighten the bolts to between 25 and 30 lbf in (0.282 and 0.339 mdaN).

(7) Wire-lock the bolts in accordance with 20-21-13.

(8) Completely unscrew the spool coupling nuts. Reset the spool end joints (Ref. Fig. 402) (Joints A and B).

(9) Reconnect and tighten the spool coupling nuts in accordance with 20-23-21.

(10) Secure the bonding lead to the bonding lug on the valve motor, with the bolt, washer and nut. Torque-tighten the bolt to between 9 and 11 lbf in (0.102 and 0.124 mdaN).

(11) Connect the electrical connector to the valve, ensuring that the mating surfaces are clean and undamaged.

(12) Check the bonding of the installation in accordance with 20-27-11.

E Conclusion

(1) Reset the jettison valve circuit breakers previously tripped.

(2) Carry out a Functional Test, a Flow Test and a Leakage Test (Ref. Adjustment/Test).

(3) Remove the warning placards from the fuel management and refuel control panels.

(4) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(5) Reset the landing gear (UC) circuit breakers previously tripped.

3. <u>Valve Motor</u> (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Cricuit breaker safety clips	-
Torque spanner, 28 to 32 lbf in (0.316 to 0.362 mdaN)	-

B. Prepare to Remove Valve Motor

(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing), and that the refuelling control access panel is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that the position of the switches must not be changed.

(3) Ensure that the tail landing gear is lowered.

(4) Trip the following circuit breakers and fit safety clips.

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K17
LH JET MASTER VALVE SUP & IND	3-213	1Q302	A7
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

R **ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH JET MASTER VALVE SUP & IND	1-213	2Q302	K18
LH JET MASTER VALVE SUP & IND	3-213	1Q302	A7
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6
UC POSN IND	1-213	G51	N16

(5) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

C. Remove Valve Motor

(1) Remove the locknuts securing the motor to the studs on the valve body.

(2) Note the position of the bonding attachments and remove the bonding leads and bonding lug.

(3) Disconnect the electrical connector and remove the motor from the valve body.

D. Install Valve Motor

(1) Comply with the fuel and electrical safety precautions.

(2) Ensure that the position of the valve motor coincides with the position of the valve.

NOTE: The mechanical indicator at '0' signifies that the motor is in the valve-open position; the indicator at 'S' signifies that the motor is in the valve-shut position.

(3) Check that the mating faces of the valve body and motor are clean and undamaged; check also that the splined drives are clean and free from burrs.

(4) Align the master splines and assemble the motor to the valve body.

(5) Refit the bonding lug and bonding leads to the valve body studs in the positions previously noted.

(6) Fit the self-locking nuts to the studs. Torque-tighten the nuts to between 28 and 32 lbf in (0.316 and 0.362 mdaN).

(7) Connect the electrical connector to the motor, ensuring that the mating surfaces are clean and undamaged.

(8) Check the bonding of the installation in accordance with 20-27-11.

E. Conclusion

(1) Reset the jettison valve circuit breakers previously tripped.

(2) Carry out a Functional Test and a Flow Test (Ref. Adjustment/Test).

(3) Remove the warning placards from the fuel management and refuel control panels.

(4) Remove the tail landing gear jack locking sleeve (Ref. 12-37-00, Tail Gear Wheel).

(5) Reset the landing gear (UC) circuit breakers previously tripped.

MASTER JETTISON VALVES - ADJUSTMENT/TEST

WARNING: OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two master jettison valves are mounted on the rear face of tank 11 rear bulkhead.

Control switches for the valves are located under a hinged transparent panel on the fuel management panel. The switches have three positions: OPEN, SHUT and OFF; the switches are normally at OFF.

This topic comprises a Functional Test, a Leakage Test and a Flow Test. The left-hand valve procedures are described, with the right-hand valve differences added in brackets.

If a motor/gearbox unit has been replaced, only a Functional and a Flow test are required.

2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panel, warning that a test is in progress and the position of the switches must not be altered.

(3) Ensure that the tail landing gear is lowered.

(4) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6

(5) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(6) Make available electrical ground power as detailed in 24-41-00.

C. Test

(1) With the JETTISON MASTER VALVES LH (RH) switch at OFF, check that the associated magnetic indicator displays bar-across-line.

(2) Set the switch to "SHUT"; check that the associated indicator display remains bar-across-line.

(3) Check that the mechanical indicator pointer on the valve is at position S.

(4) Set the switch to "OPEN" and check that -

(a) the associated magnetic indicator display changes from bar-across-line to diagonal stripes, then to bar-in-line within 3 s, and

(b) the mechanical indicator pointer on the valve is at position O.

(5) Set the switch to "SHUT" and check that -

(a) the associated indicator display changes from bar-in-line to diagonal stripes, then to bar-across-line within 3 s, and

(b) the mechanical indicator pointer on the valve is at position S.

(6) Set the switch to "OFF". Check that the associated indicator display remains bar-across-line.

R After SB 28-020 For A/C 001-004,

R (7) Reset the switch to "OPEN" and check that the
R associated magnetic indicator displays the
R correct indications.

R (8) Set the switch to "OFF" and check that -

R (a) the associated indicator display changes
R from bar-in-line to diagonal stripes
R then to bar-across-line within 3 s, and

R (b) the mechanical indicator pointer on the
R valve changes from position O to position S.

D. Conclusion

(1) Remove the locking sleeve from the tail landing gear jack (Ref. 12-37-00).

(2) Reset the circuit breakers previously tripped.

(3) Remove the warning placards from the fuel management and refuel control panels.

(4) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Leakage Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Pressure test blank	E925154000
Container, 20 gal (90 l) capacity, for fuel spillage	-
Torque spanner, 60 to 70 lbf in (0.68 to 0.79 mdaN)	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing), and the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panel, warning that a test is in progress and the position of the switches must not be altered.

(3) Ensure that the tail landing gear is lowered.

(4) Trip the circuit breakers listed below and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
UC LOWER DOORS OPEN SUP	15-215	G3	A8
UC RAISE DOORS CLOSE SUP	15-215	G1	A6

(5) Fit a locking sleeve to the tail landing gear jack (Ref. 12-37-00, Tail Gear Wheel).

(6) Make available electrical ground power as detailed in 24-41-00.

(7) Set the engine feed 1 (4) LP VALVE switch to "SHUT 1". Check that the associated indicator display changes to bar-across-line.

(8) Ensure that the skin area surrounding the jettison outlet is clean and free from grease.

(9) Lubricate the seal on the test blank in accordance with 20-23-11.

NOTE: Four 0.25 in (6.35 mm) dia. countersunk-head bolts are fitted through the tail cone skin adjacent to the jettison outlet.

(10) Remove and retain the four countersunk-head bolts, nuts and washers and fit the test blank over the jettison outlet, with the test blank nuts, washers and bolts. Tighten the bolts evenly. Ensure that

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the bleed valve on the test blank is closed.

(11) Position the container at the jettison outlet.

(12) Ensure that the collector tank 1 (4) is full of fuel. Refuel if necessary (Ref. 12-11-28, Refuelling).

NOTE: The tank must be full or the underfull signal will close the collector tank jettison valve when the fuel level drops below 80 per cent full.

C. Test

(1) Set the tank 1 (4) collector tank jettison valve switch to "OPEN". Check that the indicator display changes to bar-in-line.

(2) Set the LH (RH) JETTISON MASTER VALVES switch to "OPEN". Check that the indicator display changes to bar-in-line.

(3) Set the tank 1 (4) engine feed 1st or 2nd standby pump (Ref. 28-21-00) switch to "ON". Check that the associated LOW PRESS caption is extinguished as pump pressure builds up.

(4) Bleed air out of the jettison pipes by slightly opening the bleed valve on the test blank. When a steady air-free flow of fuel from the valve is obtained, close the bleed valve.

(5) Continue to pressurize the jettison pipes for a period of not less than 5 min. During this period check that there are no fuel leaks from the tank 11 rear bulkhead mounting, the jettison valve and the piping through to the pipe outlet.

(6) Switch off the engine standby pump.

(7) Set the collector tank jettison valve switch to "SHUT". Check that the associated indicator display changes to bar-across-line.

(8) Set the LH (RH) JETTISON MASTER VALVES switch to "SHUT". Wait until the associated indicator display changes to bar-across-line, then set the switch to "OFF".

R After SB 28-020 For A/C 001-004,

R (8) Set the LH (RH) JETTISON MASTER VALVES switch
R to "OFF"; check that the associated indicator
R display changes to bar-across-line.

(9) Open the bleed valve on the test blank and allow fuel to drain from the jettison pipe.

D. Conclusion

(1) Remove the test blank, complete with bolts, washers and nuts, from the jettison outlet. Refit the four countersunk-head bolts, washers and nuts previously removed. Torque-tighten the nuts to between 60 and 70 lbf in (0.68 and 0.79 mdaN).

(2) Allow residual fuel to drain into the container, then remove all spilt fuel from the tail-cone skin.

(3) Set the engine feed 1 (4) LP VALVE switch to "OPEN". Check that the associated indicator display changes to bar-in-line.

(4) Remove the locking sleeve from the tail landing gear jack (Ref.12-37-00, Tail Gear Wheel).

(5) Reset the circuit breakers previously tripped.

(6) Remove the warning placards from the fuel management and refuel control panels.

(7) Switch off and disconnect electrical ground power as detailed in 24-41-00.

4. Flow Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Container, 300 gal (13,500 l) capacity, suitably calibrated for fuel jettison test	-
Bonding lead, for aircraft to container	-

B. Prepare

(1) Ensure that all fuel management panel switches are at their normal ground positions (Ref. 28-00-00, Servicing) and that the refuel control panel access door is closed.

(2) Attach placards to the fuel management and refuel control panels, warning that a test is in progress and the position of the switches must not be altered.

(3) Make available electrical ground power as detailed in 24-41-00.

CAUTION: WITH TANK 9 FULL AND TANK 11 EMPTY, ENSURE THAT THE COMBINED TOTAL CONTENTS OF FUEL IN TANKS 10, 1, 4, 5 AND 8 IS AT LEAST 10,000 kg GREATER THAN THE COMBINED CONTENTS OF TANKS 5A, 6, 2, 3, 7 AND 7A.

(4) Ensure that tank 1 (4) is full of fuel. Refuel (Ref. 12-11-28, Servicing) if necessary.

NOTE: The tank must be full, or the underfull signal will close the collector tank jettison valve when the fuel level drops below 80 per cent full.

CAUTION: DUE TO THE HIGH JETTISON FLOW RATE, I.E., MORE THAN 100 gal/min (450 l/min), THE CONTAINER MUST BE POSITIONED AS CLOSE AS POSSIBLE TO THE JETTISON OUTLET, WITH A DEFLECTOR SHIELD ATTACHED TO THE CONTAINER TO DEFLECT THE FUEL INTO THE CONTAINER.

THE DEFLECTOR MUST NOT IMPEDE THE FUEL FLOW.

(5) Position the container at the jettison outlet and electrically bond the container to the aircraft.

(6) Set the engine feed 1 (4) LP VALVE switch to "SHUT 1". Check that the associated indicator display changes to bar-across-line.

C. Test

(1) Set tank 1 (4) collector tank jettison valve switch to "OPEN". Check that the associated indicator display changes to bar-in-line.

(2) Set the tank 1 (4) engine feed 1st and 2nd standby pumps (Ref. 28-21-00) switches to "ON". Check that the associated LOW PRESS captions are extinguished

as pump pressure builds up.

(3) Set the LH (RH) JETTISON MASTER VALVES switch to "OPEN" for 1 min only, then set the switch to "SHUT". Wait until the associated magnetic indicator display changes to bar-across-line, then set the switch to "OFF". During this procedure check that -

(a) fuel flow from the jettison outlet commences within 3 s of switch operation,

(b) fuel flow from the jettison outlet ceases within 3 s of switch operation, and

(c) the quantity of fuel jettisoned is not less than 111 gal (500 l).

(4) Set the tank 1 (4) engine feed 1st and 2nd standby pumps switches to "OFF".

(5) Set the collector tank 1 (4) jettison valve switch to "SHUT". Check that the associated indicator display changes to bar-across-line.

D. Conclusion

(1) Defuel the container; disconnect the bonding from the container and aircraft and remove the container.

(2) Remove all spilt fuel from the tail-cone skin.

(3) Set the engine feed 1 (4) LP VALVE switch to "OPEN". Check that the associated indicator display changes to bar-in-line.

(4) Remove the warning placards from the fuel management and refuel control panels.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

END OF THIS SECTION

NEXT

INDICATING - DESCRIPTION AND OPERATION

1. General

Fuel system indicating consists of the monitoring functions of six parameters.

(1) Fuel leakage.

(2) Fuel level.

(3) Engine feed low pressure.

(4) Fuel quantity.

(5) Fuel temperature.

(6) Fuel tank pressure.

The fuel leakage detection system (Ref. 28-41-00) provides a warning indication if a sufficient quantity of fuel leaks from the fuel system into the dry bay area above an engine. Warning is given by a red LEAK caption on the lower fuel management panel, at the third crew member's (3CM) station.

Fuel level indication (Ref. 28-42-00), which is additional to fuel quantity indication, is designed to given an accurate indication of the volume of fuel in the aircraft fuel tanks at certain prescribed levels, as well as to provide automatic control functions during aircraft refuelling, fuel transfer and fuel jettison. Levels in the various tanks are indicated by a series of caption lights on the fuel management panels.

The fuel feed to each engine is provided with a low pressure warning circuit (Ref. 28-43-00), in which an amber LOW PRESS caption on the lower fuel management panel signals any unacceptable loss of fuel pressure.

Fuel quantity indication (FQI) (Ref. 28-44-00) consists basically of one or more capacitance-type probes in each fuel tank transmitting information to its associated indicator on the fuel management panels, and the duplicate instrument on the ground refuelling control panel. In addition to the individual analogue-type (with digital counters) fuel contents indicators, two digital total fuel contents indicators are provided, one on the fuel management panel, the other on the pilot's instrument panel. Two further c.g. indicators indicate the aircraft c.g. in relation to fuel state and mach limits; an FQI control panel accommodates a third 'seven-bar' display-type c.g. indicator. The fuel

quantity indication system also provides load limit control (trim transfer and refuelling), mach - c.g. limits indication and associated warnings.

The fuel temperature indication system (Ref. 28-45-00) monitors the fuel temperature at each collector tank outlet, and at the associated engine inlet, by means of sensors, which convey the necessary information to a twin dial indicator on the fuel management panel.

The fuel tanks are pressurized at a predetermined altitude and this pressure, as well as any variation, positive or negative, is sensed by a pressure transmitter. Indication of tank pressure is given by an indicator and a warning caption at the 3CM station (Ref. 28-46-00).

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00, AND THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00, SERVICING.

ENSURE THAT THE AIRCRAFT CONFIGURATION SATISFIES THE CONDITIONS DETAILED IN 12-00-10, 'AIRCRAFT GROUND STABILITY'.

1. General

This topic comprises an Operational Test and a Functional Test. The Operational Test is a straightforward test of an FQI probe, with or without a capacitance index compensator (CIC) but no level sensor, accessible overwing, where no performance faults are present.

In the case of a fuselage tank, because of the necessity to drain the tank for the associated probe removal from the bottom of the tank, the Operational Test cannot be implemented. In these circumstances the capacitance section of the Functional Test must be performed.

The Functional Test utilizes three test sets, one of which is in three separate units. This test comprises the following:-

(1) A Level Sensor Test, consisting of a test at the tank wall connectors to ensure that the level sensors for each probe (FQI or dummy) function correctly, by simulating the sensors in air or fuel conditions, with verification being signalled by red and green warning lamps. For clarity the level sensors are identified as follows:

Overfull - OF

High level - HL

Underfull - UF

Low level - LL

(2) An Insulation Resistance, FQI Probe and CIC Capacitance Test, comprising:-

(a) An insulation resistance test, tank by tank.

(b) A test of FQI probe and CIC capacitance individually or as a chain, tank by tank.

The Operational Test is performed with the tanks in normal conditions, filled to an appropriate level.

The Functional Test is performed with the tanks fuelled to a level that is appropriate to the probe replacement (drained in the case of a fuselage cell). The tank can be in any configuration from normal fuel level to unpumpable or dry in relation to the tank dummy probe location.

A System Test is not considered necessary in this application.

2. Operational Test

R NOTE: This test is valid for any FQI probe, with or without a
R CIC, accessible overwing, with no gauging fault present
R when renewed. It is not a test of level sensors.

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) By internal transfer (Ref. 28-22-00) set the tank contents to between one quarter and one half full (nominal) to obviate the possibility of fuel spillage when a probe is removed, and to ensure that the fuel level is below the lowest high level (HL) sensor, irrespective of the aircraft attitude.

(3) Note the fuel contents indicator reading of the appropriate tank and ensure that no further fuel movement takes place.

(4) Refer to Table 501; then remove the appropriate probe and install the new probe, as detailed in the relevant Maintenance Manual topic.

TANK NO.	MAINTENANCE MANUAL TOPIC REFERENCE
1 and 4	28-44-11 R/I
2 and 3	28-44-12 R/I
5 and 8	28-44-31 R/I

TANK NO.	MAINTENANCE MANUAL TOPIC REFERENCE
5A and 7A	28-44-32 R/I
6 and 7	28-44-33 R/I
9	28-44-51 R/I
10	28-44-52 R/I
11	28-44-71 R/I

Probe Removal/Installation Topic References
Table 501

B. Test

(1) With the new probe installed, check that the associated indicator reading agrees with that obtained in operation A.(3), within the tolerances detailed in Table 502.

TANK NO.	TOLERANCE (kg)
1, 2, 3, 4, 5, 7, 5A and 7A	±70
6 and 8	±120
9, 10 and 11	±150

FQI Tolerances for Retest
Table 502

(2) Using the aircraft pumps and fuel transfer system (Ref. 28-22-00), empty the tank down to the unpumpable fuel level; then refill to HL shut-off.

(3) Check that at each state, empty and HL, the associated indicator reading agrees with Table 503.

(4) Refer to the fuel management panel 5-214; on

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the FQI control panel set the multi-position rotary (MPR) switch to "GAUGES" and the test switch to "TEST" and check that the contents indicator readings show the following increases:-

Tanks 1, 2, 3, 4, 5A and 7A: 200(±50) kg

Tanks 5, 6, 7 and 8: 500(±100) kg

Tanks 9 and 10: 500(±150) kg

Tank 11: 3,000(±200) kg

NOTE: Each tank indicator must read greater than zero, at the commencement of this test, to ensure that each CIC is immersed in fuel.

There must be no comparator warnings illuminated for tanks 9, 10 and 11 during this test.

TANK NO.	UNPUMPABLE FUEL QTY. (kg)	HL (REFUEL kg)	HL (INTERNAL TRANSFER kg)
1 and 4	0-50	4,190(±60)	-10
2 and 3	150-250	4,560(±60)	-10
5A and 7A	0-50	2,220(+100 -0)	0 (Not applicable)
5	0-50	7,140(±60)	-10
6	0-100	11,560(±150)	+10
7	0	7,390(±100)	0
8	0-100	12,810(±150)	-80
9	100-200	11,000(±150)	-50
10	0-100	11,910(±150)	-10
11	0-100	10,400(±100)	0 (Not advised)

FQI Tolerances and Quantities at Unpumpable and HL Fuel Levels
Table 503

(5) Check that the digital readout of the totalizer (total contents) indicators (pilots' and 3CM) is increased by approximately 7,200 kg (the sum total of the error value of the contents indicators).

NOTE: A comprehensive test of the FQI system is contained in 28-44-00, Adjustment/Test.

(6) Release the TEST - CANCEL switch and set the MPR switch to "OFF" and check that the contents and totalizer indicators assume their original readings.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
High level hysteresis sensor test set	TE5049102
High level sensor test set	TE5049101
Single level sensor (OF, LL, UF) test set	TE5049103
Test loom (24-way), tanks 1 to 8 and 10	TE5049201
Test loom (15-way), tanks 5A, 7A, 9 and 11	TE5049202
Fuel tank probe capacitance test set	TE5051
Precision variable capacitors (one of each type)	General Radio Type 1422CB and 1422CC
Test harness (plug BAS 8198; Souriau connector S2071)	-
Test harness (plug BAS 8195; Souriau connector S2240)	-

DESCRIPTION	PART NO.
Fuel tank insulation test set	TE6006000
Test loom	TE6006203
Test loom	TE6006202
Test loom	TE6006204

B. Prepare

(1) Trip the appropriate circuit breakers and fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D5
TANKS 1 & 2 UF TANKS 3 & 4 LL SUP & IND	3-213	Q1220	D6
TANKS 3 & 4 UF TANKS 1 & 2 LL SUP & IND	1-213	Q1221	J16
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C2
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 9, 10, 11 REFUEL FQI & FLT COUNT SUP	13-215	Q1365	C17

(2) Remove the appropriate access panel(s) listed in Table 504 and identify the FQI or tank level indication probe harness connectors to be disconnected for the Level Sensor Test (Ref. para.C.).

TANK NO.	FQI CONN. CODE NO.	TANK LEVEL CONN. CODE NO.	ZONE	PANEL REF.
1	Q1080A	Q1197A	193	193 AB
2	Q1083A	Q1202A	197	197 BB
3	Q1088A	Q1203A	198	198 BB
4	Q1085A	Q1196A	194	194 AB
5	Q1081A	Q1199A	193	193 FB
6	Q1082A	Q1201A	195	195 BB
7	Q1087A	Q1200A	196	196 BB
5A	Q1084A	Q1205A	543	543 AT
7A	Q1089A	Q1204A	643	643 AT
8	Q1086A	Q1198A	194	194 FB
9RH	Q1077A	Q1193A	191	191 KB
9LH	Q1078A	Q1194A	192	192 KB
10RH	Q1091A	Q1195A)		

TANK NO.	FQI CONN. CODE NO.	TANK LEVEL CONN. CODE NO.	ZONE	PANEL REF.
10LH	Q1090A	Q1195A)	192	192 MB
11RH	Q1093A	-	323	323 BR
11LH	Q1092A	-	323	323 BL
11RH & LH	-	Q1206A	323	323 BL

Tank Harness Connector Access Panel Location
Table 504

C. Level Sensor Test

(1) Prepare to Test Level Sensor

NOTE: To perform this test the following three test sets are required:-

TE5049103 - used as a detector unit for simple OF, LL and UF probes, for all tanks.

TE5049102 - used as a detector unit for HL hysteresis probes, which are installed in all tanks except 5A, 7A and 11.

TE5049101 - used as a detector unit for single HL sensors in tanks 5A, 7A and 11 only.

A switchable 28 V d.c. supply must be made available to the test sets.

If a probe fails the following test it must be identified and renewed (Ref. Table 501) and then retested.

If a faulty probe is an FQI probe with level sensors, the associated Operational and/or Capacitance Tests must be performed.

(a) Transfer fuel from the tank to be tested until all the level sensors are uncovered (Ref. 28-22-00).

(b) Disconnect the appropriate level sensor connector from the tank wall.

(c) Identify the connector pins and number the flying leads of the appropriate test lead (24-way for all tanks except 5A, 7A, 9 and 11, which utilize the 15-way connector), for each tank in turn.

(d) Attach suitable single-pin plugs to the flying leads, to enable them to be plugged into the test set; then connect the test lead to the tank wall level connector receptacle.

(2) Test Level Sensor

(a) Using test set TE5049103, proceed as follows:-

a1) With the test set 28 V d.c. power supply switched off, connect the supply cables to the test set +ve and -ve terminal posts.

a2) Refer to Table 505 for tank 1; then, commencing with the OF level sensor mounted on probe Q1121, select the three flying leads numbered 4, 5 and 6 and plug them into the test set as follows:-

Lead 4 into the GROUND socket

Lead 5 into the SIGNAL socket

Lead 6 into the POSITIVE socket

a3) Switch on the power supply to the test set and check that the red AIR warning lamp is lit.

a4) Unplug lead 6 from the POSITIVE socket for between 15 and 30 s; then reconnect it and check that the green FUEL lamp flashes momentarily, followed by a steadily lit red lamp.

a5) Switch off the power supply and unplug the flying leads from the test set.

a6) Referring to Tables 506 to 518, as appropriate, identify the pins/flying leads for the remaining sensors of tank 1 and repeat operations a2), a3), a4) and a5) for the OF, UF and LL sensors only.

CAUTION: DO NOT ATTEMPT TO TEST HL SENSORS WITH THIS TEST SET.

a7) Identify the level connector pin/flying lead combination and perform the test on the remaining tanks, except for the HL sensors (with or without hysteresis).

(b) At the conclusion of a satisfactory test of the OF, UF and LL sensors substitute test set TE5049102 for TE5049103 and proceed as follows:-

b1) Commencing at probe Q1332, tank 1, and with the power supply to the test set switched off, connect the pin/flying leads into the test set as follows:-

Lead 7 into the GROUND socket

Lead 8 into the SIGNAL socket

Lead 9 into the POSITIVE socket

Lead 10 into the '19' socket

b2) Switch on the 28 V d.c. power supply and check that the red AIR warning lamp is lit.

b3) Operate the push-switch and check that the red lamp goes out and the green FUEL lamp is lit.

b4) Release the push-switch and check that the green lamp goes out, and the red AIR lamp is lit.

b5) Switch off the power supply and unplug the flying leads from the test set.

b6) Referring to Table 505, identify the pins/flying leads for the remaining hysteresis HL sensors (all tanks except 5A, 7A and 11) identified from the Table by the additional pin connection; repeat operations b1) to b6).

(c) For the last section of this test for the HL probes (without hysteresis) in tanks 5A, 7A and 11, substitute test set TE5049101 for TE5049102 and proceed as follows:-

c1) Refer to Table 513 (tank 5A), and identify the pin/flying-lead combination for the HL sensor on probe Q1338; plug the flying leads into the test set as follows:-

Lead 4 into the GROUND socket

Lead 5 into the SIGNAL socket

Lead 6 into the POSITIVE socket

c2) Switch on the power supply to the test set and check that the red AIR warning lamp is lit.

c3) Operate the push-switch and check that the red lamp goes out and the green FUEL lamp is lit.

c4) Release the push-switch and check that the green lamp goes out and the red AIR lamp is lit; switch off the power supply.

c5) Repeat operations c1) to c4) for the remaining HL probes in tanks 7A and 11.

(3) Conclusion

(a) If no further testing is necessary, proceed as follows:-

a1) Remove the test leads and test sets from the aircraft.

a2) Connect the level sensor tank wall connectors in accordance with the

applicable wiring diagram.

a3) Replace all access panels.

a4) Re-establish the tank fuel levels as necessary.

a5) Reset the circuit breakers tripped at the commencement of the test.

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1121	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1332	GROUND	17	) OF
(Dummy)	SIGNAL	18	)
	POSITIVE	19	)
Q1332	GROUND	7	) HL
	SIGNAL	8	) (hysteresis)
	POSITIVE	9	)
	19	10	)
Q1208	GROUND	11	) UF
(Dummy)	SIGNAL	12	)
	POSITIVE	13	)
Q1208	GROUND	14	) LL
	SIGNAL	15	)
	POSITIVE	16	)
Q1123	GROUND	4	) OF
(FQI)	SIGNAL	5	)
	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 1 - Tank Wall Level Connector Q1197A
Table 505

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1128	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1129	GROUND	20	) OF
(FQI)	SIGNAL	21	)
	POSITIVE	22	)
Q1129	GROUND	7	) HL
	SIGNAL	8	) (hysteresis)
	POSITIVE	9	)
	19	10	)
Q1129	GROUND	11	) UF
	SIGNAL	12	)
	POSITIVE	13	)
Q1129	GROUND	14	) LL
	SIGNAL	15	)
	POSITIVE	16	)
Q1130	GROUND	17	) LL
(FQI)	SIGNAL	18	)
	POSITIVE	19	)
Q1131	GROUND	4	) OF
(FQI)	SIGNAL	5	)
(CIC)	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 2 - Tank Wall Level Connector Q1202A
Table 506

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1142	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1143	GROUND	20	) OF
(FQI)	SIGNAL	21	)
	POSITIVE	22	)
Q1143	GROUND	7	) HL
	SIGNAL	8	) (hysteresis)
	POSITIVE	9	)
	19	10	)
Q1143	GROUND	11	) UF
	SIGNAL	12	)
	POSITIVE	13	)
Q1143	GROUND	14	) LL
	SIGNAL	15	)
	POSITIVE	16	)
Q1144	GROUND	17	) LL
(FQI)	SIGNAL	18	)
	POSITIVE	19	)
Q1145	GROUND	4	) OF
(FQI)	SIGNAL	5	)
(CIC)	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 3 - Tank Wall Level Connector Q1203A
Table 507

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1125	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1333	GROUND	17	) OF
(Dummy)	SIGNAL	18	)
	POSITIVE	19	)
Q1333	GROUND	7	) HL
	SIGNAL	8	) (hysteresis)
	POSITIVE	9	)
	19	10	)
Q1207	GROUND	11	) UF
(Dummy)	SIGNAL	12	)
	POSITIVE	13	)
Q1207	GROUND	14	) LL
	SIGNAL	15	)
	POSITIVE	16	)
Q1127	GROUND	4	) OF
(FQI)	SIGNAL	5	)
(CIC)	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 4 - Tank Wall Level Connector Q1196A
Table 508

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1209	GROUND	1	) OF
(Dummy)	SIGNAL	2	)
	POSITIVE	3	)

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PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1209	GROUND	4	) HL
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)
Q1335 (Dummy)	GROUND	8	) OF
	SIGNAL	9	)
	POSITIVE	10	)
Q1335	GROUND	11	) HL
	SIGNAL	12	) (hysteresis)
	POSITIVE	13	)
	19	14	)

Probe and Test Set Connector Identification -
Tank 5 - Tank Wall Level Connector Q1199A
Table 509

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1119 (FQI) (CIC)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1119	GROUND	4	) HL
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)

Probe and Test Set Connector Identification -
Tank 8, Fuselage Cell - Tank Wall Level Connector Q1198A
Table 510

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1337 (Dummy)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1337	GROUND	4	) HL
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)

Probe and Test Set Connector Identification -
Tank 6 - Tank Wall Level Connector Q1201A
Table 511

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1103 (FQI)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1103	GROUND	4	) HL
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)
Q1400 (Dummy)	GROUND	8	) OF
	SIGNAL	9	)
	POSITIVE	10	)
Q1400	GROUND	11	) HL
	SIGNAL	12	) (hysteresis)
	POSITIVE	13	)
	19	14	)

Probe and Test Set Connector Identification -
Tank 7 - Tank Wall Level Connector Q1200A
Table 512

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1336 (Dummy)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1336	GROUND	4	) HL
	SIGNAL	5	)
	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 5A - Tank Wall Level Connector Q1205A
Table 513

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1338 (Dummy)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1338	GROUND	4	) HL
	SIGNAL	5	)
	POSITIVE	6	)

Probe and Test Set Connector Identification -
Tank 7A - Tank Wall Level Connector Q1204A
Table 514

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1132 (FQI)	GROUND	1	) OF
	SIGNAL	2	)
	POSITIVE	3	)
Q1132	GROUND	4	) HL

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)

Probe and Test Set Connector Identification -
Tank 9 LH (Channel A) - Tank Wall Level Connector Q1194A
Table 515

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1139	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1139	GROUND	4	) HL
	SIGNAL	5	) (hysteresis)
	POSITIVE	6	)
	19	7	)

Probe and Test Set Connector Identification -
Tank 9 RH (Channel B) - Tank Wall Level Connector Q1193A
Table 516

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Channel A (LH)			
Q1163	GROUND	1	) OF
(FQI)	SIGNAL	2	)
	POSITIVE	3	)
Q1163	GROUND	7	) HL
	SIGNAL	8	) (hysteresis)
	POSITIVE	9	)
	19	10	)

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Channel B (RH)			
Q1162	GROUND	4	) OF
(FQI)	SIGNAL	5	)
	POSITIVE	6	)
Q1162	GROUND	11	) HL
	SIGNAL	12	) (hysteresis)
	POSITIVE	13	)
	19	14	)

Probe and Test Set Connector Identification -
Tank 10 LH and RH - Tank Wall Level Connector Q1195A
Table 517

PROBE IDENT.	TEST SET PLUG IDENT.	PIN/FLYING LEAD NO.	SENSOR TYPE
Q1168	GROUND	1	) OF
(FQI)	SIGNAL	2	)
(CIC)	POSITIVE	3	)
Q1168	GROUND	4	) HL
	SIGNAL	5	)
	POSITIVE	6	)
Q1401	GROUND	7	) OF
(Dummy)	SIGNAL	8	)
	POSITIVE	9	)
Q1401	GROUND	10	) HL
	SIGNAL	11	)
	POSITIVE	12	)

Probe and Test Set Connector Identification -
Tank 11 - Tank Wall Level Connector Q1206A
Table 518

D. Insulation Resistance, FQI Probe and CIC Capacitance Test

(1) Test Insulation Resistance

NOTE: Test set TE6006000 is used for this test.

(a) Transfer fuel from the tank down to the unpumpable fuel level (Ref. 28-22-00).

(b) Carry out the instructions detailed in 'B. Prepare', paragraphs (1) and (2).

(c) Check that the tank level sensor connector has not been disconnected.

(d) Check the test set batteries for serviceability:-

d1) Set the OPER - BATT switch to "BATT".

d2) Switch on the test set by operating the PULL ON switch.

d3) Check that on the test meter the scale pointer has moved to a position between the red markers at 4 and infinity.

d4) Reset the OPER - BATT switch to "OPER".

d5) Press the PULL ON switch to switch off the test set.

(e) Refer to Table 504; then disconnect the FQI connector from the tank wall, commencing at tank 1, for a full system test.

(f) On the test set, check that the PULL ON switch is down, and the rotary SW1 switch is at OFF.

(g) Connect test loom TE6006202 to the FQI receptacle and to the test set.

(h) Connect test loom TE6006204 to the test set and a suitable part of the aircraft structure to provide a good earth connection.

(i) With the RANGE 'ohm' switch set to '10 to the power of 8' for switch SW1 positions 1 to 11, and '10 to the power of 7' for SW1 positions 12, 13 and 14, operate the PRESS TO READ button, select switch SW1 positions "1" to "14", in turn, and check that at each position the megohm meter scale pointer reads at least 5.

NOTE: After SB 28-013 switch position '6' is inoperable.

(j) Release the PRESS TO READ button and return switch SW1 to "OFF".

(k) Return the PULL ON switch to the 'off' position.

(l) At the conclusion of a satisfactory test, disconnect the test looms from the aircraft.

(m) Repeat operations (d) to (l) for the remaining tanks.

NOTE: If a tank fails the foregoing test, an individual probe insulation resistance test will be required.

(n) Substitute test loom TE6006203 for test loom TE6006202 at the tank wall; repeat operation (h).

(o) With the appropriate individual connector 1s-1, and so on, (Ref. Table 519) connected to the test set, perform operations (i) to (l) for each individual probe until the fault is located.

(p) Refer to the appropriate Removal/Installation (Ref. Table 501); then carefully lift the probe from the tank and examine the probe terminals and harness for faulty or loose connections, breaks or other damage.

(q) If no faults are apparent, renew and retest the probe.

(r) Disconnect and remove the test looms and test set from the aircraft.

(2) Test FQI Probe and CIC Capacitance (Ref. Fig. 501)

R B CAUTION: A REQUIREMENT THAT CAPACITANCE PROBES REMOVED
R B FROM THE AIRCRAFT AS FAULTY, ARE CHECKED USING
R B HANGAR CAPACITANCE MEASURING BEFORE BEING
R B REJECTED.

R B NOTE 1: This check is to take place AFTER the probe
R B has been removed from the aircraft IN
R B ADDITION to any probe checks called-up with
R B the probes still fitted.

R B NOTE 2: It is possible that the occasional bad
R B connection may cause an apparent probe fault

R B when installed in the aircraft and the disturbance of that connection during probe removal may inadvertently correct the problem. This additional check does not apply to probe removal for level switching faults.

R B NOTE 3: This test is applicable after SB 28-013.

The tanks must be dry, or the fuel level reduced to the unpumpable.

Test set TE5051 is used for this test.

During this test two General Radio (GR) variable precision capacitors are employed, in conjunction with the test set. The capacitors are connected to the test set by flying leads.

A precision scale correction chart, with a validity period of six months, must accompany each GR precision capacitor. This chart is used to improve the integrity of the scale reading required. The desired setting must be attained in the direction of increased scale reading to reduce the error of backlash. The scale correction chart is interpreted thus:- The algebraic sum of the dial reading and the appropriate scale correction give the generated capacitance.

Individual probe and CIC capacitance tests are normally necessary only if the summed (total chain) measurement is not within the specified limits, to determine the identity of the faulty component(s).

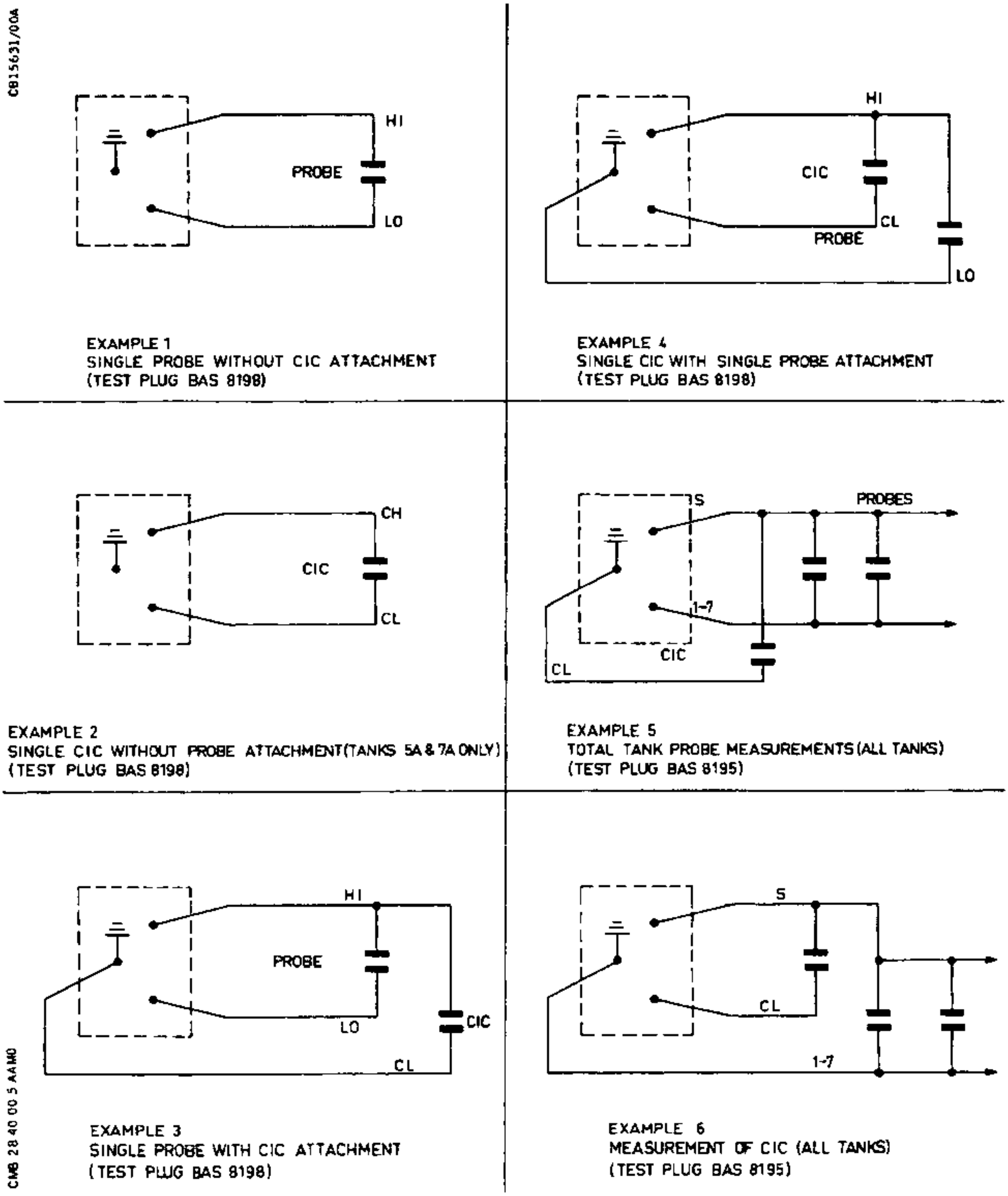
Probe and CIC identifications and their capacitance values are detailed in Table 519.

(a) Transfer fuel from the tank down to the unpumpable fuel level (Ref. 28-22-00), and ensure that the tank is ventilated as detailed in 28-10-00, Servicing.

(b) Carry out the instructions detailed in 'B. Prepare', paragraphs (1) and (2).

(c) Refer to Table 504; then disconnect the FQI connector from the wall of the tank to be tested.

(d) Connect the plug (BAS 8198 or 8195) of the appropriate test harness from the test set



Test Connection Arrangement
Figure 501

TE5051 to the tank wall receptacle.

NOTE: The test harness plug BAS 8198 is used for all single probe or CIC tests; plug BAS 8195 is used for summed probe or CIC capacitance tests.

(e) Make available to the test set a switchable 115 V a.c. 400 Hz power supply.

(f) Connect the test set earthing cable to a suitable point on the aircraft structure.

(g) Connect either the Type 1422CC (1100 pF) or the Type 1422CB (110 pF) GR variable precision capacitor to the test set KNOWN terminals, depending on the range required.

(h) Refer to the illustration (Ref. Fig. 501) and Table 519 and connect the appropriate probe and CIC cables to the UNKNOWN and earthing sockets on the test set, as necessary.

NOTE: In the illustration (Ref. Fig. 501), example 1 (FQI probe without CIC), typical connections to the test set UNKNOWN terminals for 'Hi' and 'Lo' are 1s-1, 2s-2 etc.

In example 2 (tanks 5A and 7A only, dummy probe with CIC) the connections are CH and CL.

In example 3 (FQI probe with CIC) the connections are similar to those for example 1 with the addition of connection CL to the test set earth terminal.

In example 4 (single CIC with FQI probe attachment), e.g., the 1s-1 (UNKNOWN) and CL (earth) connections are moved to become 1s-CL (UNKNOWN) and 1 (earth).

In example 5 a similar arrangement exists, S and 1-7 (UNKNOWN) with CL (earth), for summed (total) tank probe capacitance measurement, becoming, in example 6 (summed (total) CIC

capacitance), S and CL (UNKNOWN) with 1-7 (earth).

If test set TE5051 is not available, the tolerances detailed in Table 519 may be widened by 0.5 per cent up and down, and rounded off, as shown in the following example:-

Original capacitance (pF) = 29.97 to 28.47

Revised capacitance (pF) = 27.8 to 28.6

(i) With the test set connections made, and the 115 V a.c. power supply switched on, adjust the precision capacitor being used to obtain test set balance, by progressively adjusting the capacitor to maximum sensitivity conditions. Wait for at least 10 min before proceeding with the test.

(j) Read off the measured value (pF) of the probe and CIC capacitance; then, using the correction chart, correct the reading and compare the result with Table 519 for the associated tank under test.

(k) Repeat the test for each tank set of summed capacitance and CIC values.

(l) If any results obtained in operations (i) or (j) are not within the specified limits, perform a test of individual probes as required, using the appropriate precision capacitor.

NOTE: Because of the characteristics of FQI probes, it is possible for the summed capacitance of a tank probe chain to exceed the stated tolerances, whereas an individual test may show that each probe is within its own tolerance. If this is so, then the worst case probe(s) must be renewed to restore the tank chain summed capacitance to the stated tolerances, high or low.

(m) Refer to Table 501 and, if necessary, renew any faulty probe; retest the individual probe and tank set.

(3) Conclusion

(a) At the conclusion of a satisfactory test, switch off and disconnect the test set power supply.

(b) Disconnect the test harness and earth cable, and remove them and the test set from the aircraft.

(c) Install the FQI tank wall connector in accordance with the appropriate wiring diagram.

(d) If no further tests are required at this juncture, refit the tank access panel (Ref. 53-00-00 or 57-00-00).

(e) Cancel the electrical safety precautions taken before the commencement of the test.

(f) Switch off and disconnect electrical ground power as detailed in 24-41-00.

NOTE A: The probes annotated 'Refer to NOTE A' in Table 519 are connected in parallel internally and their summed capacitance applies.

TANK NO.	PROBE OR CIC IDENT.	CONN. PIN NOS.	FIG. 502 TEST EX.	CAPACITANCE (pF) PER PROBE OR CIC		FIG. 502 TEST EX.	TOTAL (SUMMED) CAPACIT-ANCE (pF) PER TANK
	PROBE						
1	Q1120	3s-3	1	61.49 to 62.11	)	5	140.71 to
	Q1121	2s-2	1	62.45 to 62.99	)		141.72
	Q1122	1s-1	1	6.78 to 7.18	)		
	Q1123	4s-4	3	10.74 to 11.14	)		
	CIC	4s-CL	4	27.97 to 28.47		6	27.97 to
	(Q1123)						28.47
	PROBE						
2	Q1130	3s-3	1	64.21 to 64.91	)	5	156.41 to
	Q1129	2s-2	1	39.92 to 40.42	)		157.45
	Q1128	1s-1	1	41.59 to 42.09	)		
	Q1131	4s-4	3	11.97 to 12.27	)		
	CIC	4s-CL	4	27.97 to 28.47		6	27.97 to

TANK NO.	PROBE OR CIC IDENT.	CONN. PIN NOS.	FIG. 502 TEST EX.	CAPACITANCE (pF) PER PROBE OR CIC	FIG. 502 TEST EX.	TOTAL (SUMMED) CAPACIT-ANCE (pF) PER TANK
	(Q1131)					28.47
	PROBE					
3	Q1142	1s-1	1	41.59 to 42.09)	5	156.41 to 157.45
	Q1143	2s-2	1	39.92 to 40.42)		
	Q1144	3s-3	1	64.21 to 64.91)		
	Q1145	4s-4	3	11.97 to 12.27)		
	CIC (Q1145)	4s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
4	Q1124	3s-3	1	61.49 to 62.11)	5	140.71 to 141.72
	Q1125	2s-2	1	62.45 to 62.99)		
	Q1126	1s-1	1	6.78 to 7.18)		
	Q1127	4s-4	3	10.74 to 11.14)		
	CIC (Q1127)	4s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
5	Q1146	1s-1	1	49.19 to 49.61)	5	196.84 to 197.78
	Q1147	2s-2	1	28.44 to 28.84)		
	Q1148	3s-3	1	38.24 to 38.64)		
	Q1149	4s-4	1	70.30 to 70.90)		
	Q1150	5s-5	3	10.80 to 11.00)		
	CIC (Q1150)	5s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
6	Q1158)	5s-5	1	91.72 to 92.72)	5	310.07 to 311.51
	Q1157)			Refer to NOTE A)		
	Q1156	3s-3	1	33.49 to 34.01)		
	Q1155)	1s-1	1	75.27 to 76.27)		
	Q1154)			Refer to NOTE A)		
	Q1151	6s-6	1	41.07 to 41.57)		
	Q1153	2s-2	1	19.70 to 20.15)		
	Q1152	4s-4	1	48.46 to 49.05)		
	CIC (Q1151)	6s-CL	4	28.17 to 28.67	6	28.17 to 28.67

TANK NO.	PROBE OR CIC IDENT.	CONN. PIN NOS.	FIG. 502 TEST EX.	CAPACITANCE (pF) PER PROBE OR CIC	FIG. 502 TEST EX.	TOTAL (SUMMED) CAPACIT-ANCE (pF) PER TANK
	PROBE					
7	Q1102	1s-1	1	26.22 to 26.62)	5	200.565 to 201.635
	Q1103	2s-2	1	49.56 to 50.04)		
	Q1104	3s-3	1	44.71 to 45.25)		
	Q1105	5s-5	1	46.83 to 47.29)		
	Q1106	4s-4	3	33.20 to 33.70)		
	CIC (Q1106)	4s-CL	4	27.50 to 28.00	6	27.50 to 28.00
	PROBE					
8	Q1112)	3s-3	1	87.59 to 88.41)	5	346.70 to 348.14
	Q1113)			Refer to NOTE A)		
	Q1116	4s-4	1	28.44 to 28.84)		
	Q1115)	6s-6	1	81.65 to 82.45)		
	Q1114)			Refer to NOTE A)		
	Q1117	5s-5	1	22.99 to 23.49)		
	Q1118	1s-1	1	44.60 to 45.10)		
	Q1119	2s-2	3	80.85 to 81.75)		
	CIC (Q1119)	2s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
9 CH.A	Q1109	1s-1	1	23.22 to 23.62)	5	364.677 to 366.323
	Q1110	2s-2	1	70.67 to 71.31)		
	Q1111	3s-3	1	52.91 to 53.39)		
	Q1139	5s-5	1	53.28 to 53.76)		
	Q1138	6s-6	1	86.90 to 87.70)		
	Q1137	4s-4	3	77.86 to 78.58)		
	CIC (Q1137)	4s-CL	4	29.97 to 28.47	6	27.97 to 28.47
	PROBE					
9 CH.B	Q1096	4s-4	1	23.22 to 23.62)	5	364.677 to 366.323
	Q1097	5s-5	1	70.67 to 71.31)		
	Q1098	6s-6	1	52.91 to 53.39)		
	Q1132	1s-1	1	53.28 to 53.76)		
	Q1133	2s-2	1	86.90 to 87.70)		
	Q1108	3s-3	3	77.86 to 78.58)		
	CIC	3s-CL	4	27.97 to 28.47	6	27.97 to

TANK NO.	PROBE OR CIC IDENT.	CONN. PIN NOS.	FIG. 502 TEST EX.	CAPACITANCE (pF) PER PROBE OR CIC	FIG. 502 TEST EX.	TOTAL (SUMMED) CAPACITANCE (pF) PER TANK
	(Q1108)					28.47
	PROBE					
10	Q1162	4s-4	1	100.20 to 101.04)	5	265.348 to
CH.A	Q1159	1s-1	1	77.24 to 77.88)		266.612
	Q1160	2s-2	1	40.20 to 40.60)		
	Q1161	3s-3	3	47.90 to 48.30)		
	CIC (Q1161)	3s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
10	Q1165	3s-3	1	77.24 to 77.88)	5	265.348 to
CH.B	Q1166	4s-4	1	40.20 to 40.60)		266.612
	Q1163	1s-1	1	100.20 to 101.04)		
	Q1164	2s-2	3	47.90 to 48.30)		
	CIC (Q1164)	2s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
11	Q1167	2s-2	1	219.55 to 221.86)	5	452.726 to
CH.A	Q1168	1s-1	3	235.93 to 238.32)		456.214
	CIC (Q1168)	1s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
11	Q1169	2s-2	1	219.55 to 221.86)	5	452.726 to
CH.B	Q1170	1s-1	3	235.93 to 238.32)		456.214
	CIC (Q1170)	1s-CL	4	27.97 to 28.47	6	27.97 to 28.47
	PROBE					
5A	Q1171	1s-1	1	12.10 to 12.40)	5	79.725 to
	Q1172	2s-2	1	16.20 to 16.50)		80.460
	Q1173	3s-3	1	13.20 to 13.50)		
	Q1174	4s-4	1	15.58 to 15.88)		
	Q1175	5s-5	1	10.47 to 10.77)		
	Q1176	6s-6	1	11.82 to 12.12)		
	CIC	CH-CL	2	27.97 to 28.47	6	27.97 to

TANK NO.	PROBE OR CIC IDENT.	CONN. PIN NOS.	FIG. 502 TEST EX.	CAPACITANCE (pF) PER PROBE OR CIC	FIG. 502 TEST EX.	TOTAL (SUMMED) CAPACIT-ANCE (pF) PER TANK
	(Q1177)					28.47
	PROBE					
7A	Q1178	1s-1	1	12.10 to 12.40)	5	79.725 to 80.460
	Q1179	2s-2	1	16.20 to 16.50)		
	Q1180	3s-3	1	13.20 to 13.50)		
	Q1181	4s-4	1	15.58 to 15.88)		
	Q1182	5s-5	1	10.47 to 10.77)		
	Q1183	6s-6	1	11.82 to 12.12)		
	CIC (Q1184)	CH-CL	2	27.97 to 28.47	6	27.97 to 28.47

Probe Capacitance Values
Table 519

LEAKAGE - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The fuel leakage detection system provides a warning indication if a sufficient quantity of fuel leaks from the fuel system into the dry bay area above an engine. An engine system comprises four float switches in the dry bay,
R a red LEAK warning caption on panel 5-214 at the third crew member's (3CM) station, and associated circuitry; each caption light incorporates press-to-test and dimming facilities (Ref. 33-14-00).

2. Float Switch

The float switch assembly consists of a perforated outer casing, open at the bottom, to which a tube is attached. A float slides along the tube and is designed to trigger a reed switch inside the tube at a predetermined float position. A balance weight incorporated in the float linkage prevents the float from rising to operate the reed switch under negative G conditions.

To obviate spurious warnings, which may be occasioned by the inadvertent operation or malfunction of a single float switch, the switches are series-connected in pairs, so that two switches are required to operate, to complete the circuit to the associated warning caption. The switches are wired together to operate in the following combinations:-

(1) Both switches in the dry bay forward area.

(2) Both switches in the rear area.

(3) The left forward with the left rear.

(4) The right forward with the right rear.

3. Operation (Ref. Fig. 002)

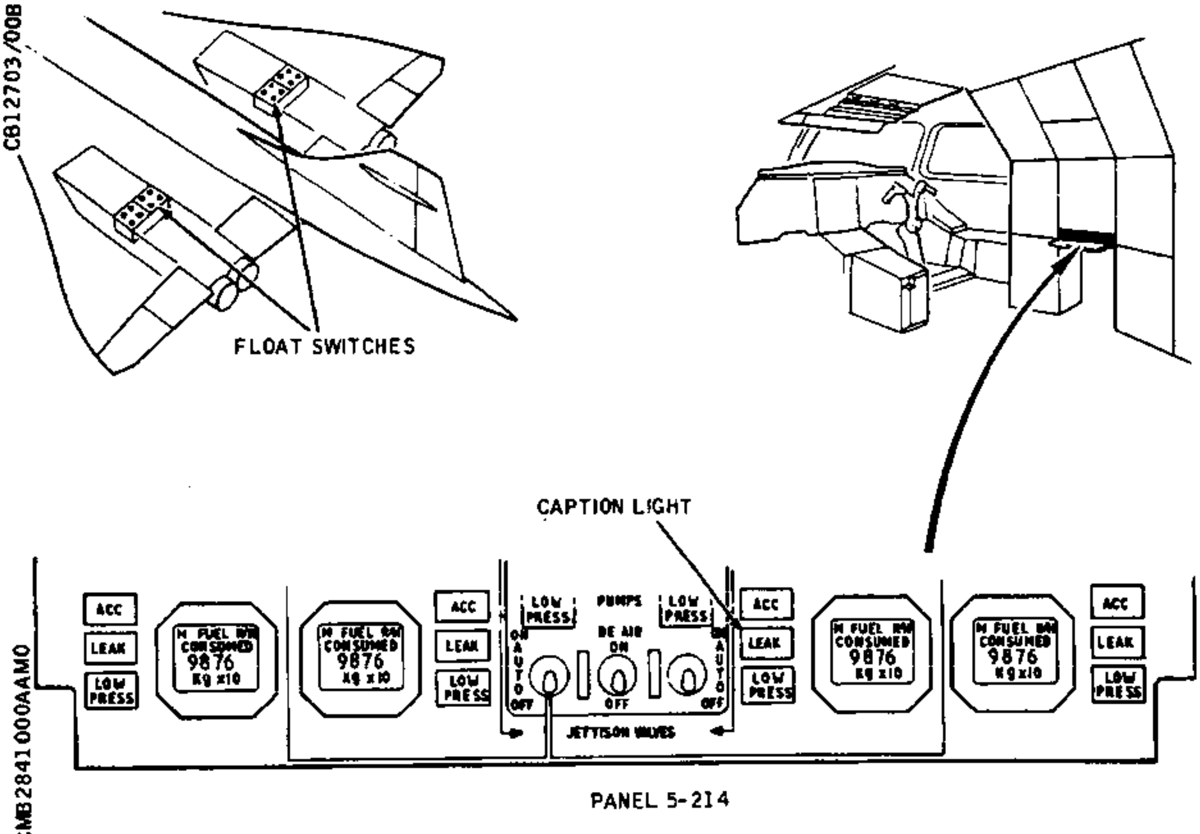
A. Functional Description

If fuel leaks into any dry bay in sufficient quantity, the float in a particular switch in the area affected slides up its support tube until, at a predetermined level, the reed switch operates. Provided the necessary two switches operate (Ref. para.2.), irrespective of the aircraft attitude, whether on the ground or in flight (within the normal operational limitations), the associated No.1, 2, 3 or 4 engine dry bay LEAK
R caption is illuminated and a red ENG master warning is

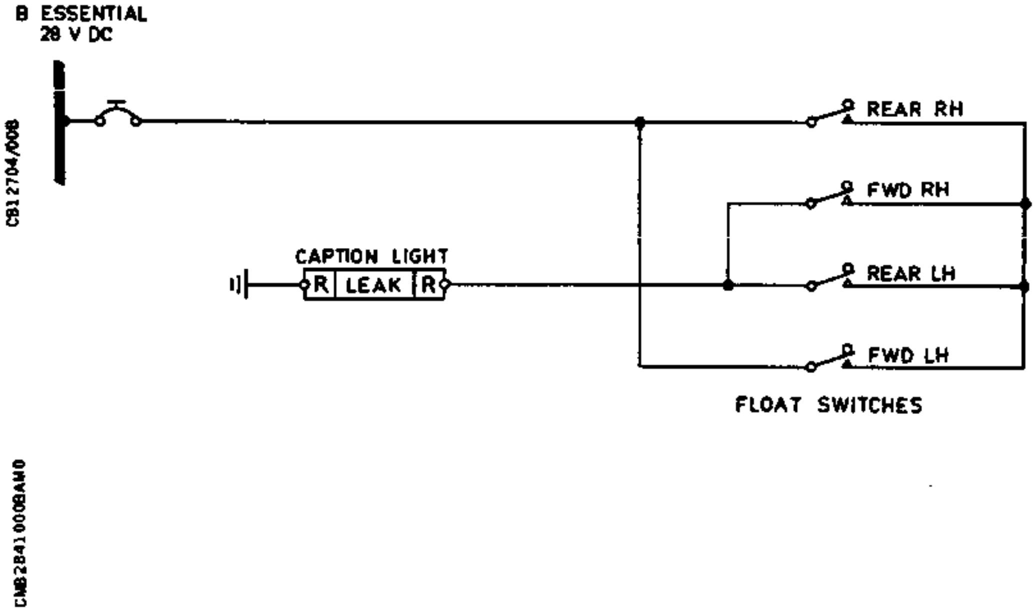
given (Ref. 33-15-00).

B. Electrical Power Supplies

Electrical power supplies for the fuel leakage indication system are taken from the 'B' essential 28 V d.c. busbar for engines 1 and 2, and from the 'A' essential 28 V d.c. busbar for engines 3 and 4.



R - Fuel Leak Captions and Float Switch Locations
Figure 001



R - Leakage Indication, No.1 Engine - Simplified Schematic
Figure 002

LEAKAGE - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

As the leakage indication systems for the four engines are similar, the procedure for each system is the same. Where identical components are involved, for example, one in each circuit, all references to the associated components listed in Table 101 are given, thus 'Renew Circuit Breaker (1), (2), (3) or (4)'.

2. Preparation

A. Ensure that the associated circuit breakers are set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Gain access to the engine dry bay, No.1, 2, 3 or 4, as appropriate.

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D. Test the caption filaments as detailed in 33-14-00.

3. Trouble Shooting

A. Prepare to trouble shoot (Ref. para.2.). Raise the appropriate pair of float switches manually, in the No.1 (2, 3 or 4) dry bay, to the operating position. Check that the associated LEAK caption on panel 5-214 is illuminated. Repeat for each combination of switches. IF -

NOT OK —
1. Caption illuminated when only one switch operated - Chart 101.
2. Caption not illuminated when a pair of switches operated - Chart 102 (No.1 dry bay), Chart 103 (No.2 dry bay), Chart 104 (No.3 dry bay), Chart 105 (No.4 dry bay).

OK —

B. Release the float switches and check that the caption is extinguished.

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CAPTION ILLUMINATED WHEN ONLY ONE FLOAT SWITCH OPERATED

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the preceding run of wiring for continuity.

Raise Float Switch (5) or (8) (No.1 bay), (9) or (12) (No.2 bay), (13) or (16) (No.3 bay), (17) or (20) (No.4 bay).

→ With electrical connector disconnected and float switch open (lowered), check continuity between pin A and pin B of appropriate paired Switches (6) or (7) (No.1 bay), (10) or (11) (No.2 bay), (14) or (15) (No.3 bay), (18) or (19) (No.4 bay).

→ YES → *Renew switch.

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Chart 101

CAPTION NOT ILLUMINATED WHEN PAIR OF FLOAT SWITCHES OPERATED

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

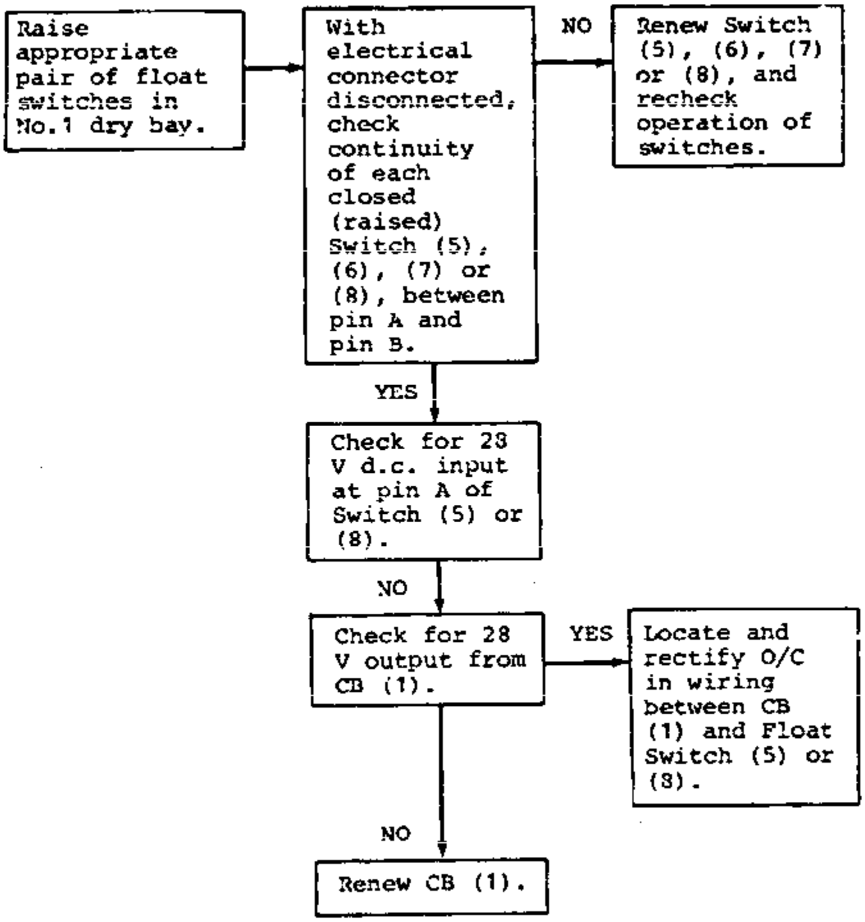

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Chart 102

CAPTION NOT ILLUMINATED WHEN PAIR OF FLOAT SWITCHES OPERATED

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

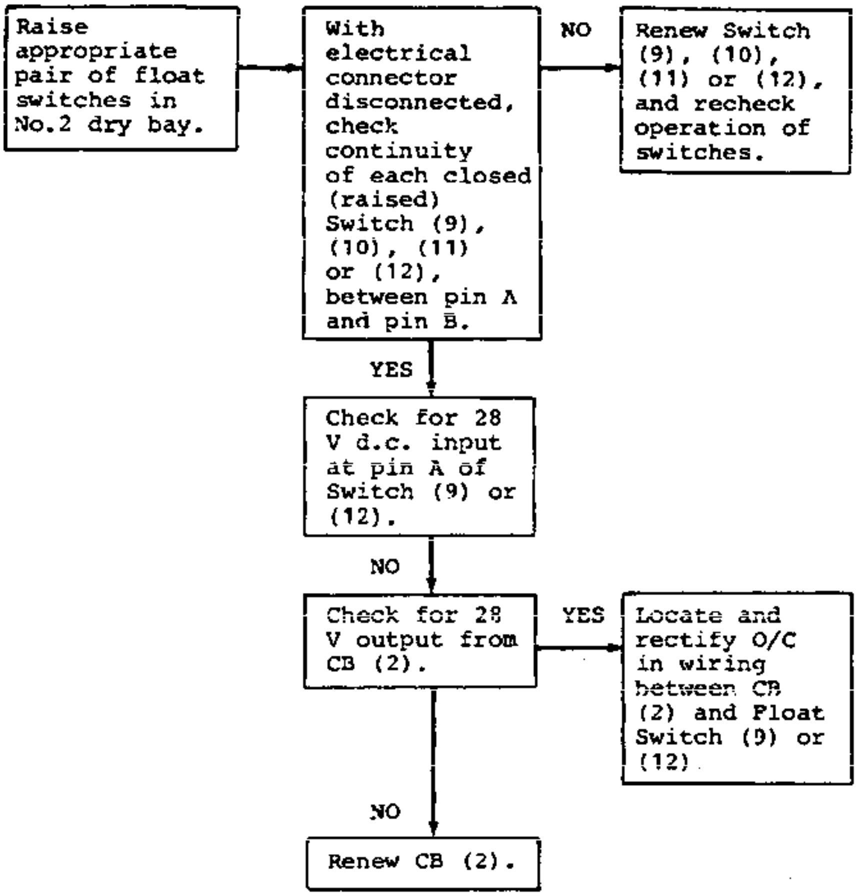

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Chart 103

CAPTION NOT ILLUMINATED WHEN PAIR OF FLOAT SWITCHES OPERATED

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

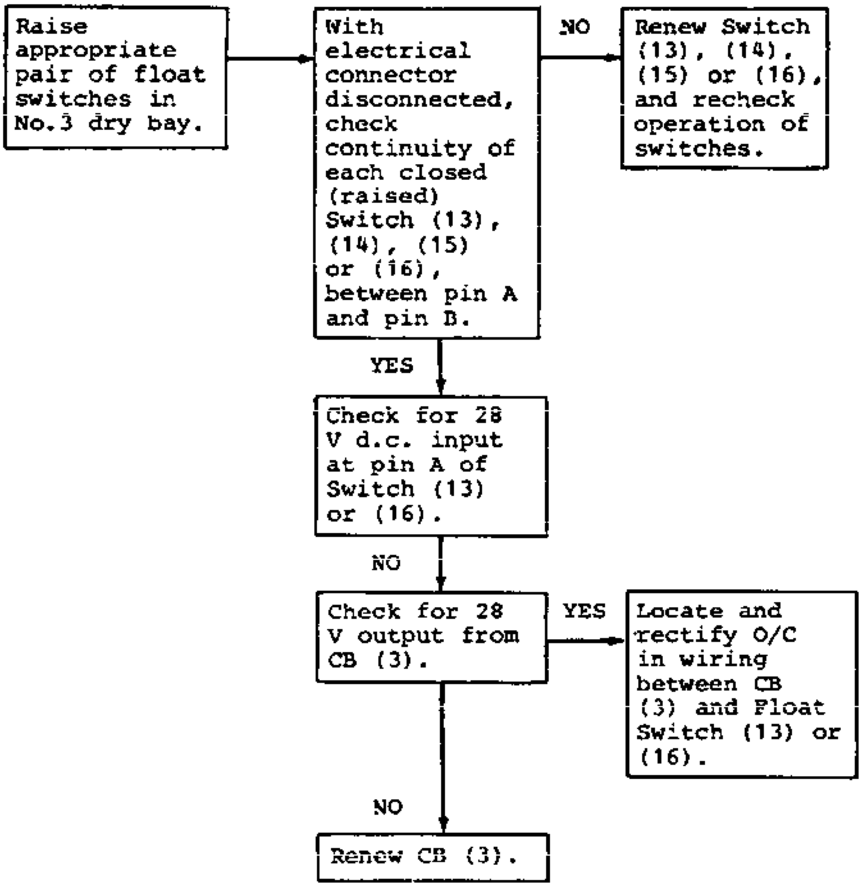

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Chart 104

CAPTION NOT ILLUMINATED WHEN PAIR OF FLOAT SWITCHES OPERATED

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

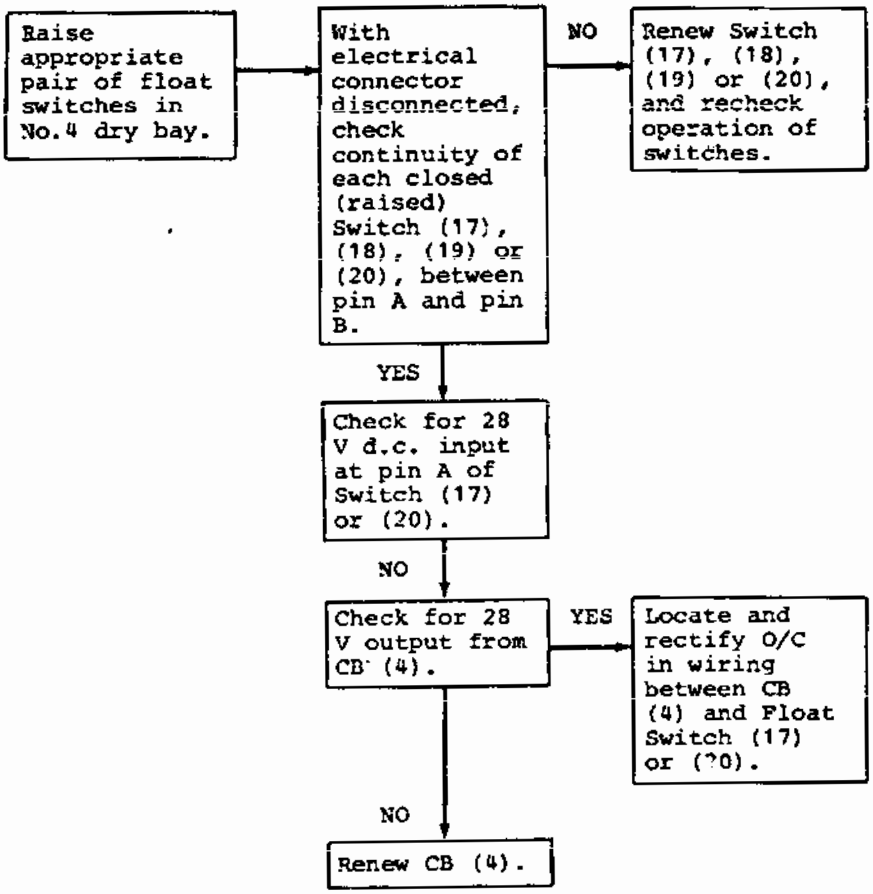

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Chart 105

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1) Circuit breaker 28 V (No.1 engine)	-	3-213	1Q81	Map ref.C5	24-50-00 R/I	28-41-01
(2) Circuit breaker 28 V (No.2 engine)	-	1-213	2Q81	Map ref.K13	24-50-00 R/I	28-41-01
(3) Circuit breaker 28 V (No.3 engine)	-	1-213	3Q81	Map ref.K14	24-50-00 R/I	28-41-01
(4) Circuit breaker 28 V (No.4 engine)	-	3-213	4Q81	Map ref.C6	24-50-00 R/I	28-41-01
(5) Left front float switch	532AT	-	1Q83	No.1 dry bay front	28-41-11 R/I	28-41-01
(6) Left rear float switch	532CT	-	1Q85	No.1 dry bay rear	28-41-11 R/I	28-41-01
(7) Right front float switch	532AT	-	1Q84	No.1 dry bay front	28-41-11 R/I	28-41-01
(8) Right rear float switch	532CT	-	1Q86	No.1 dry bay rear	28-41-11 R/I	28-41-01
(9) Left front float switch	531AT	-	2Q83	No.2 dry bay front	28-41-11 R/I	28-41-01
(10) Left rear float switch	531BT	-	2Q85	No.2 dry bay rear	28-41-11 R/I	28-41-01
(11) Right front float switch	531AT	-	2Q84	No.2 dry bay front	28-41-11 R/I	28-41-01
(12) Right rear float switch	531BT	-	2Q86	No.2 dry bay rear	28-41-11 R/I	28-41-01
(13) Left front	631AT	-	3Q83	No.3 dry	28-41-11	28-41-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
float switch				bay front	R/I	
(14) Left rear float switch	631BT	-	3Q85	No.3 dry bay rear	28-41-11 R/I	28-41-01
(15) Right front float switch	631AT	-	3Q84	No.3 dry bay front	28-41-11 R/I	28-41-01
(16) Right rear float switch	631BT	-	3Q86	No.3 dry bay rear	28-41-11 R/I	28-41-01
(17) Left front float switch	632AT	-	4Q83	No.4 dry bay front	28-41-11 R/I	28-41-01
(18) Left rear float switch	632CT	-	4Q85	No.4 dry bay rear	28-41-11 R/I	28-41-01
(19) Right front float switch	632AT	-	4Q84	No.4 dry bay front	28-41-11 R/I	28-41-01
(20) Right rear float switch	632CT	-	4Q86	No.4 dry bay rear	28-41-11 R/I	28-41-01

Component Identification
Table 101

LEAKAGE - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

In this Functional Test the float switches are operated manually, with a locally manufactured tool. Access to the float switches is through removable panels on the top surface of the wing. Operational and System Tests are not considered necessary in this application.

2. Functional Test

NOTE: Two operators, equipped with a suitable form of communication, are required to perform this test.

A. Equipment and Materials

DESCRIPTION	PART NO.
Float lifting tool	Local manufacture
Access panel key	E920132000

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Using the key, unlock and remove the appropriate wing access panels listed in Table 501.

FLOAT SWITCH LOCATION	ZONE/ACCESS PANEL
No.1 engine bay - front	532 AT
rear	532 CT
No.2 engine bay - front	531 AT
rear	531 BT
No.3 engine bay - front	631 AT
rear	631 BT

FLOAT SWITCH LOCATION	ZONE/ACCESS PANEL
No.4 engine bay - front rear	632 AT 632 CT

Float Switch Location
Table 501

C. Test

CAUTION: ENSURE THAT THE LIFTING TOOL HAS NO SHARP EDGES, TO AVOID DAMAGING THE FLOATS.

(1) Refer to panel 5-214 at the 3CM station; press and release each LEAK caption in turn and check that the caption is illuminated, accompanied by
R a red ENG master warning and a single-stroke gong, then extinguished, with cancellation of the master warning.

(2) Using the special lifting tool, raise pairs of float switches in the following combinations,
R in the No.1, 2, 3 or 4 dry bay, as appropriate:

(a) The front pair of floats.

(b) The rear pair of floats.

(c) The left front and left rear float.

(d) The right front and right rear float.

(3) Check that the action of raising each pair of floats illuminates the associated LEAK caption,
R and initiates an ENG master warning. Ensure that the warnings are cancelled when the floats are returned to their normal operating position.

(4) Raise each individual float switch in turn and check that no warnings are given in the flight compartment.

D. Conclusion

(1) Replace the wing access panels.

(2) Switch off and disconnect electrical ground power

(Ref. 24-41-00).

FLOAT SWITCH - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Four float switches are installed in each of the four forward dry bays above the engine nacelles, with one switch bracket-mounted in each corner of the bay. The removal/installation instructions detailed are applicable to all sixteen switches.

2. Float Switch (Ref. Fig. 401)

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Circuit breaker safety clips	*
Access panel key	E920132000

R R R R

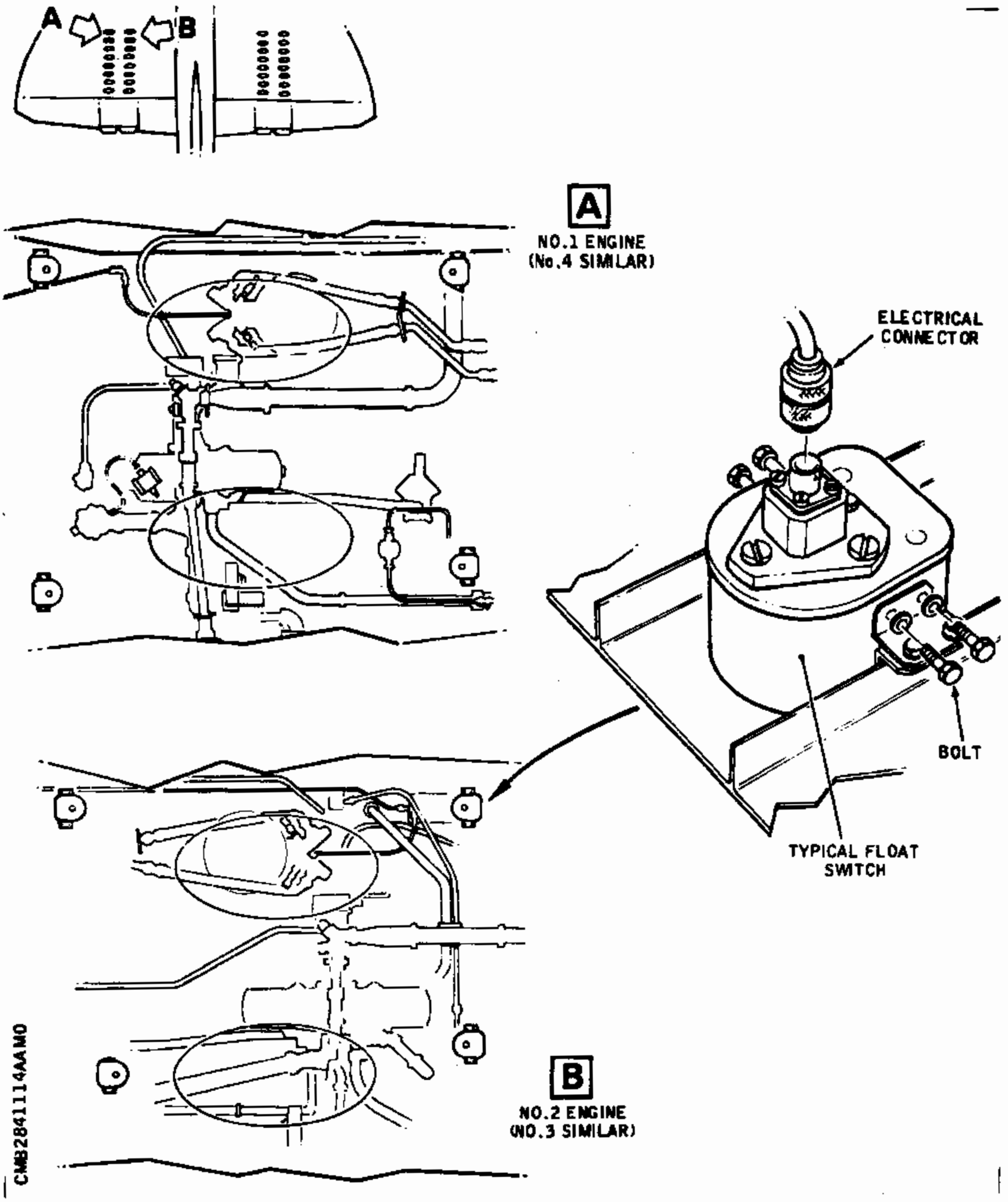
B. Prepare

(1) Electrically isolate the float switch to be removed by tripping the appropriate circuit breaker.

NOTE: Electrical power for the four float switches in each bay is supplied through one common circuit breaker.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Fuel leak indication			
No.1 engine bay	3-213	1Q81	C5
No.2 engine bay	1-213	2Q81	K13
No.3 engine bay	1-213	3Q81	K14
No.4 engine bay	3-213	4Q81	C6

(2) Using the key, unlock and remove the appropriate



Float Switch - Installation
Figure 401

wing access panel listed in Table 401.

FLOAT SWITCH LOCATION	ZONE/ACCESS PANEL
No.1 engine bay - front	532 AT
R rear	532 CT
No.2 engine bay - front	531 AT
rear	531 BT
No.3 engine bay - front	631 AT
rear	631 BT
No.4 engine bay - front	632 AT
R rear	632 CT

Float Switch Location
Table 401

C. Remove

(1) Identify the unit to be removed and disconnect the electrical connector.

NOTE: The securing bolts must be identified before removal and preferably retained separately, as those nearest to the fuselage are special bolts used for electrical bonding purposes.

(2) Remove the bolts securing the float switch to the brackets and withdraw the switch.

D. Pre-installation Checks

CAUTION: DO NOT PERFORM INSULATION CHECKS BETWEEN THE PINS OF THE ELECTRICAL CONNECTOR, AS THIS ACTION WILL DAMAGE THE UNIT.

(1) Using a suitable 500 V d.c. insulation resistance tester, check that the insulation resistance between each pin of the electrical connector and a clean metallic part of the unit is not less than 20 Mohm over a period of 5 s.

(2) With the switch held firmly in its correct operating position (open face downward), lift the float to its highest position. Tilt the switch to an angle of approximately 45 deg to its installed attitude and

release the float; check that it slides freely down the tube to its limit of travel.

(3) Invert the unit and check that the gravity weight falls to lift the float assembly to its circlip stop.

(4) Check that the unit, especially the float, is free from cracks, corrosion, dents or other damage.

E. Install

(1) Comply with the electrical safety precautions.

(2) Position the unit between the mounting brackets with the curved end of the casing (the end accommodating the electrical connector) toward the access panel aperture.

NOTE: When correctly installed the curved ends of the pairs of float switches (front and rear) face toward each other.

(3) Refer to the NOTE following paragraph C.(1), then assemble the washers on the bolts, with the chamfer on each washer toward the bolt head, and secure the switch to the brackets; tighten the bolts evenly to prevent distortion of the assembly. Ensure that the float switch is bonded electrically, in accordance with 20-27-11.

(4) Connect the electrical connector to the switch, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Reset the circuit breakers tripped before float switch removal.

(2) Perform a Functional Test of the float switch as detailed in 28-41-00, Adjustment/Test.

(3) Using the key, refit and lock the wing access panel.

LEVEL INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001, 002 and 003)

Fuel level indication is designed to give an accurate indication of the volume of fuel in the aircraft fuel tanks at certain prescribed levels, as well as to provide automatic control functions during aircraft refuelling, fuel transfer and fuel jettison.
The system is a multi-channel network, with each channel comprising one or more sensors, an amplifier, and a solid state switching circuit which, depending on the function of a particular channel, controls an indicator and/or a valve control relay. The amplifiers and associated circuitry are housed in two level switching packs, Right and Left.

Level indication is additional to Fuel Quantity Indication (FQI) (Ref. 28-44-00), and utilizes some of the FQI probes as supports, plus additional dummy probes, where necessary, to which sensors are attached at four levels: Low Level, Underfull, High Level, and Overfull. Fuel levels in the various tanks are indicated by a series of caption lights on the fuel management panels.

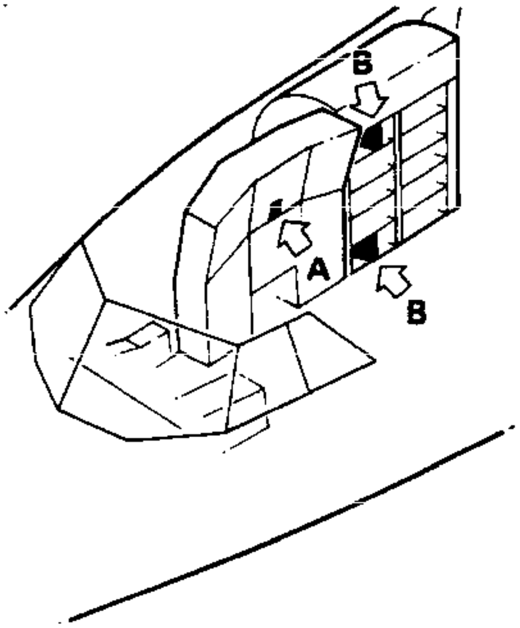
2. Sensors

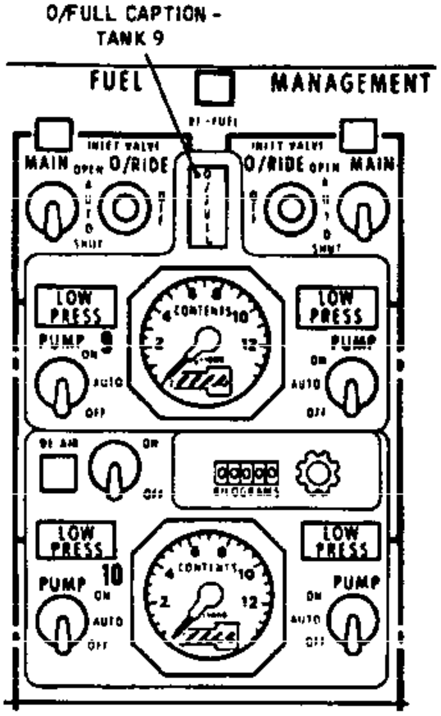
The basic level sensor comprises a detection circuit with a sensing thermistor element, a temperature stabilization network and two protection diodes. In all tanks, with the exception of Nos.5A, 7A, and 11, the high level sensors each contain two sensing thermistors, positioned one above the other to obtain a hysteretic effect.

Each level sensor is installed in a position in a fuel tank appropriate to its particular function, the total number of sensors required being dictated by the accuracy and sensitivity necessary for satisfactory level indication.

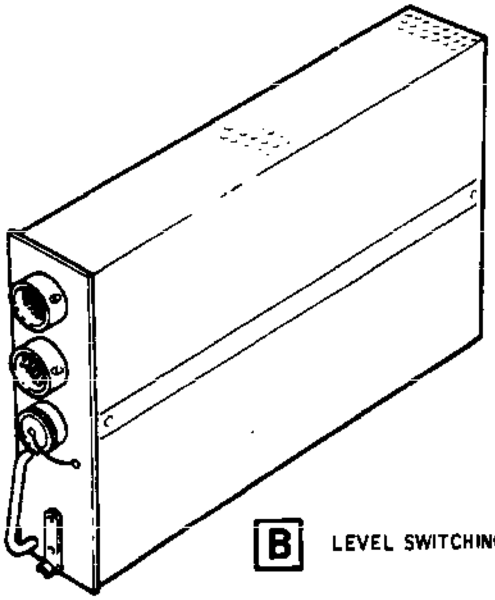
3. Level Switching Packs

The level switching packs house the amplifier circuitry and associated switching circuitry for the level switching channels. Each channel circuit has two stages; the first stage provides amplification of the signals transmitted by the sensors, and the second stage controls the appropriate switching action. Time-delay relays are incorporated in the underfull channel collector tank jettison valve control (Ref. 28-31-00), and scavenge drain and overflow valve control circuits (Ref. 28-12-00).





A PANEL 2-214



B LEVEL SWITCHING PACK

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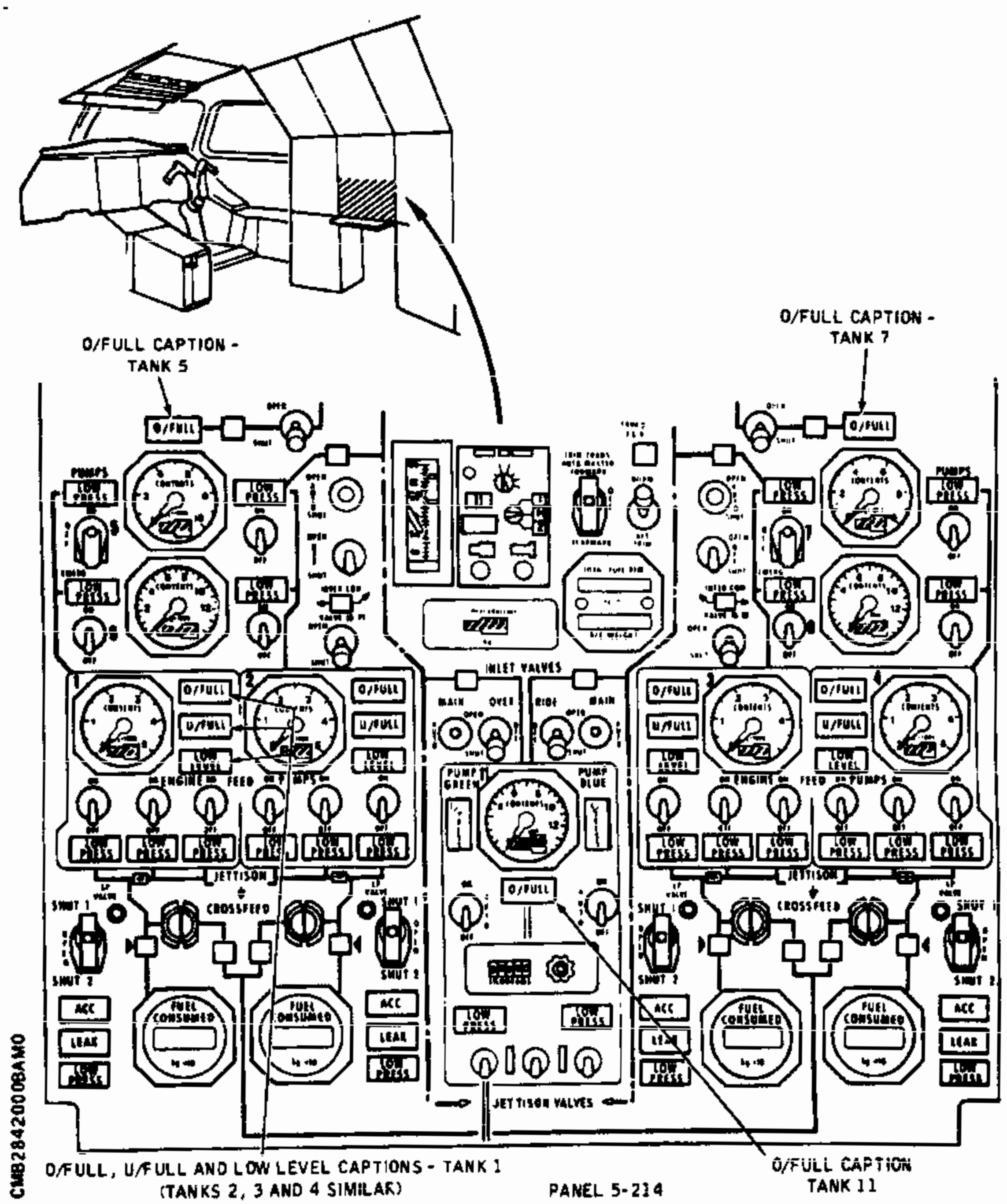
\- Upper Fuel Management Panel Level Indicator
and Location of Switching Packs
Figure 001



- Lower Fuel Management Panel Level Indicators
Figure 002

4. Level Switching Channels

Low level sensors are installed in the Nos.1, 2, 3 and 4 collector tanks only, to provide switching signals for the associated caption lights, to indicate that approximately 20 per cent of fuel remains available to the engines. Two sensors are installed at different levels, in each of the Nos.2 and 3 tanks, to provide aircraft attitude compensation; before these sensors produce a switching action, both must be immersed in fuel.

Underfull level sensors are installed in the Nos.1, 2, 3 and 4 collector tanks only, to provide switching signals to the associated caption lights. The sensors are positioned below the level of the transfer valves at approximately 80 per cent of tank volume and, apart from providing signals for visual indication, also operate the collector tank jettison valves through a 15 s time-delay relay.

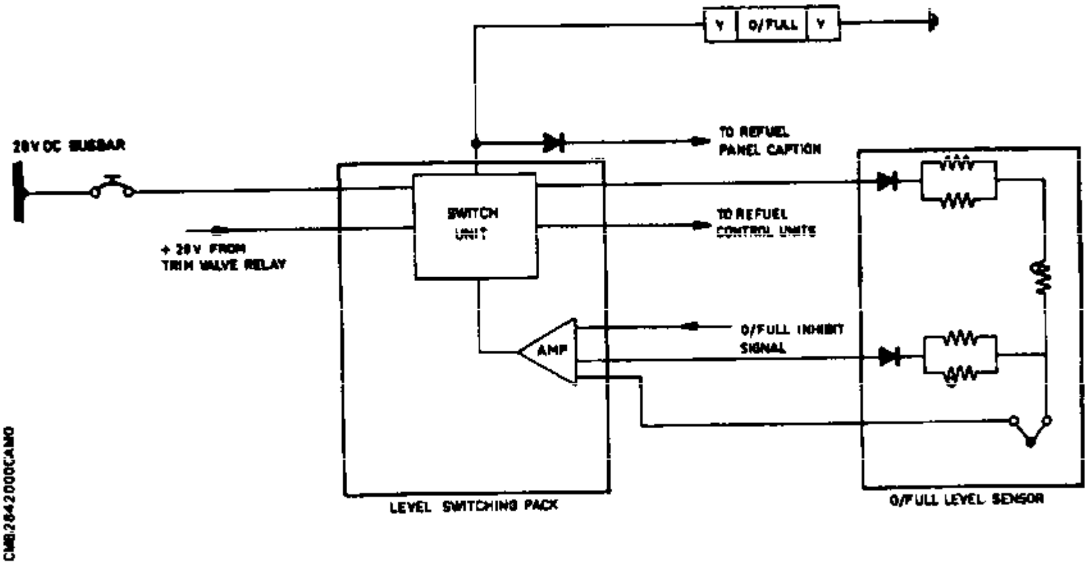
High level sensors are installed in all fuel tanks; located at the upper end of each tank, they are designed to control the closure of the refuelling valves at approximately 95 per cent volume. These sensors also operate the trim valves for tanks 9, 11, 5 and 7, and the transfer shut-off valves for tanks 5A and 7A. Two high level sensors are installed in tanks 9 and 10 to provide roll attitude compensation.

Overfull sensors are installed in all tanks and provide a switching function to close the refuelling isolation valves. Positioned at approximately 97 per cent of tank volume, the sensors provide primary control of the appropriate caption lights on the fuel management panels for tanks 1, 2, 3, 4, 5, 7, 9 and 11, in flight only, and a single caption light for all tanks on the ground refuelling panel in zone 194. Three sensors are positioned at different levels in each collector tank to provide pitch attitude compensation.

5. Operation (Ref. Fig. 001, 002 and 003)

A. Control and Indication (Ref. Fig.001 and 002)

The level indication caption lights are located on the upper and lower fuel management panels 2-214 and 5-214 at the third crew member's (3CM) station. Three captions are utilized: O/FULL and U/FULL, which are illuminated yellow, and LOW LEVEL, which is illuminated amber. The underfull and low level caption lights are connected into the Nos.1, 2, 3 and 4 collector tank circuits only; the overfull caption lights are connected into the Nos.1, 2, 3, 4, 5, 7, 9 and 11 tank circuits. A single O/FULL



- Typical Level Switching Channel - Simplified Schematic
Figure 003

caption on the refuelling panel 1-194 indicates an overfull condition in any one tank, including tanks 5A, 7A, 6, 8 and 10.

The low level caption lights are connected into the amber FUEL caption light on the master warning panel 4-211. Each low level caption light is provided with a press-to-test facility to enable pre-flight integrity tests of the associated circuits to be performed.

Control of the channel switching functions is by two level switching packs, Right and Left, on shelves 2-216 and 10-216 at the 3CM station.

B. Functional Description (Ref. Fig. 003)

The level sensors depend for their function on the thermistor characteristic of exhibiting a different resistance value when in still air, than when surrounded by fuel. When a stabilized d.c. current is connected to the sensor, any change in resistance results in a voltage change across the thermistor. The resultant

voltage change is transmitted as a signal through a temperature sensitive circuit, to a level switching pack, where it is amplified to switch on or off an associated valve control and/or a caption light.

The high level sensors, apart from controlling refuelling shut-off, also control in-flight fuel transfer by closing the appropriate valves at appproximately 95 per cent tank volume, for tanks 1, 2, 3, 4, 5, 6, 7, 8, 9, 10 and 11. To obviate unnecessary switching action, two high level sensors, installed in tanks 9 and 10, provide compensation for aircraft roll attitude; the sensors in tank 9 also control the trim valves. During refuelling operations of tanks 9 and 10, the refuelling shut-off valves operate only when both sensors are immersed in fuel. High level signals from the sensors in tanks 5 and 7 shut the appropriate transfer valves, provided that the associated pumps in tanks 5A and 7A are operating.

Apart from those installed in tanks 5A, 7A and 11, all the high level sensors comprise twin thermistors to provide a hysteretic effect, to obviate unnecessary repeated switching, and operation of associated valves, in the event of fuel surging or thermal contraction. The overfull sensors function primarily as safety factors to close the isolation valves during refuelling, if there is a high level switching failure or malfunction. Two sensors are installed in tanks 5, 7 and 11; in each tank both sensors must be immersed in fuel to produce a signal.

Three sensors are installed in the collector tanks 1, 2, 3 and 4, to provide pitch attitude compensation, as the immersion of any sensor retains the signalling facility to the indicator circuit, since the sensors are at different positions in the tanks. In tanks 9 and 10 a sensor is installed in each cell, and a signal is generated when either sensor is immersed, in each tank, to allow for the possibility of one cell overflowing before the other.

For collector tanks 1, 2, 3 and 4, when the refuelling valves are closed the O/FULL captions are inhibited, with the refuel panel access door open. However, when the refuel panel door is closed, the door-operated microswitch de-energizes an overfull inhibit relay, which overrides the previous inhibit function of the closed refuelling valves (through the closed relay contacts). The circuit to the O/FULL captions for these tanks is armed by the now open contacts, to ensure that a caption is illuminated, in flight, to

give a tank overfull warning, if a main transfer control valve fails to close during normal fuel transfer operations.

For tanks 9 and 11, with the trim valves closed, closure of the refuelling valves inhibits the O/FULL captions.

After SB 28-016 For A/C 001-005,

For tank 11, with the trim valves closed, the O/FULL caption is illuminated if the fuel in this tank reaches the overfull level.

For tanks 5 and 7, with the trim valves closed, the O/FULL captions are inhibited when the refuelling valves close, provided the inner and outer pumps for tanks 5A and 7A are not operating.

If the trim valves are opened, or in the case of tanks 5 and 7, the tanks 5A and 7A pumps are switched on, the circuit to the associated O/FULL caption is armed, to give warning, if necessary, of a tank overfull condition.

The collector tank underfull sensors, apart from giving visual indication on the fuel management panel, close the tank jettison valves (with the master jettison valves open) to prevent the fuel level from falling below approximately 80 per cent, to ensure that adequate fuel supplies remain for engine operation. LOW LEVEL captions are illuminated only if the collector tank levels fall to approximately 20 per cent, below which the level is unacceptable for continued engine operation. A signal from a sensor to a LOW LEVEL caption also initiates an amber FUEL master warning on the pilots' master warning panel. A press-to-test facility is provided to enable the circuit to be proved, as a pre-flight check, or during flight or engine operation.

C. Electrical Power Supplies

Electrical power supplies for both Right and Left level switching channels for all tanks are taken from the 'A' main, and 'A' and 'B' essential 28 V d.c. busbars.

FUEL LEVEL INDICATION - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Preparation

A. Ensure that the associated circuit breakers are set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Test the LOW LEVEL, U/FULL and O/FULL caption filaments as detailed in 33-14-00.

D. Prepare the aircraft for refuelling/defuelling as detailed in 28-24-00 and 28-25-00.

NOTE: It may be possible to adjust the various tank fuel levels, as required, by transferring fuel as detailed in 28-22-00 or 28-23-00.

3. Trouble Shooting

```
A.*******************************************
  *Prepare to trouble shoot (Ref. para.2.).*
  *Check that the LOW LEVEL caption for    *
  *each of tanks 1,2,3 and 4 is illuminated*
  *then extinguished, when pressed and     *
  *released, accompanied by an amber FUEL  *
  *master warning.  IF -                   *
  ******************************************
        |         |
        |         |          ----------------------------------
        |         |         |1. Caption is not illuminated, but|
        OK        NOT OK-------|   master warning is activated.    |
        |                   |   Renew Caption Light Module (1),|
        |                   |   (2),(3) or (4).                |
        |                   |2. Caption is not illuminated and |
        |                   |   master warning is not activated|
        |                   |   - Chart 101.                   |
        |                    ----------------------------------
        |
B.******************************************
  *Check that when fuel level in tank 1(2,*
  *3 or 4) falls below approx. 20 per cent*
  *volume (750 kg, tanks 1 and 4; 1000 kg *
  *tanks 2 and 3) the associated LOW LEVEL*
  *caption is illuminated, accompanied by *
  *an amber fuel master warning.  Check   *
  *that with fuel level raised above 20   *
  *per cent tank volume the warnings are  *
  *cancelled, and the associated LOW LEVEL*
  *caption is extinguished.  IF -         *
  *****************************************
        |         |
        |         |          ----------------------------------
        |         |         |1. LOW LEVEL caption not illumin- |
        OK        NOT OK-------|   ated when fuel level in tank 1 |
        |                   |   (2,3 or 4) below approx. 20    |
        |                   |   per cent - Chart 102.          |
        |                   |2. LOW LEVEL caption illuminated  |
        |                   |   when fuel level in tank 1(2,3  |
        |                   |   or 4) above 20 per cent - renew|
        |                   |   Probe (9) tank 1; (10) tank 4; |
        |                   |   (11) or (12) tank 2; (13) or   |
        |                   |   (14) tank 3.                   |
        |                    ----------------------------------
        |
        |
```

C. Check that, during refuelling or fuel transfer, the tank refuelling valve closes, through the action of the associated high-level sensor, and the O/FULL caption is not illuminated. IF -

NOTE: If the refuelling valve remains open, refuelling is terminated by the closure of the refuel control unit (RCU) (Ref. 28-24-00).

OK

NOT OK

1. O/FULL caption is illuminated when tank full fuel level is attained - Chart 103.
2. O/FULL caption is not illuminated, but refuelling is terminated by closure of the RCU - renew Caption Light Module (33),(34),(35),(36),(37),(38), (39),(40) or (41).
   NOTE: Tanks 6,8 and 10 utilize the O/FULL caption on the refuel panel 1-194.
3. O/FULL caption is not illuminated and fuel is discharged through overboard vent valve, due to non-closure of RCU - Chart 104.
4. O/FULL caption is illuminated, but fuel is discharged from overboard vent valves - trouble shoot refuel circuit (Ref. 28-24-00, Trouble Shooting).

```
D.*******************************************
  *Check that with the fuel level in tanks *
  *5, 7, 9, and 11 at overfull (RCU shut)  *
  *when the trim valves are set to open,   *
  *the associated O/FULL caption is        *
  *illuminated.                            *
  *NOTE:  When the fuel is at high level   *
  *       or above, the trim inlet valves  *
  *       will open only when the O/RIDE   *
  *       switch is set to OPEN            *
  *       (Ref. 28-23-00).                 *
  ******************************************
       |         |
       |         |          ------------------------------------
       |         |         |Tank 5,7,9 or 11 O/FULL caption not|
       OK        NOT OK------|illuminated when trim inlet valves |
       |                   |set to OPEN - Chart 105.           |
       |                    ------------------------------------
       |
E.*******************************************
  *Check that with the fuel level in tank 5*
  *or 7 at overfull (RCU shut) when the    *
  *associated tank 5A or 7A inner or outer *
  *pump switch is operated, the associated *
  *O/FULL caption is illuminated.          *
  ******************************************
       |         |
       |         |          ------------------------------------
       |         |         |Tank 5 or 7 O/FULL caption not     |
       OK        NOT OK------|illuminated when associated tank 5A|
       |                   |or 7A inner or outer pump switched |
       |                   |on - Chart 106.                    |
       |                    ------------------------------------
       |
F.*******************************************
  *Check that with the fuel level in tank  *
  *1, 2, 3 or 4 at overfull, the associated*
  *O/FULL caption is illuminated when the  *
  *refuel panel door is closed and exting- *
  *uished when the door is opened.         *
  ******************************************
       |         |
```

```
       |           |
       |           |            ----------------------------------
       |           |           |1. Tank 1, 2, 3 or 4 O/FULL caption|
       OK          NOT OK------|   not illuminated when refuel    |
       |                       |   panel door closed - Chart 107. |
       |                       |2. Caption illuminated with refuel |
       |                       |   panel door open - Renew Door   |
       |                       |   Microswitch (55).              |
       |                        ----------------------------------
       |
G.******************************************
  *Check that as the fuel level in coll-   *
  *ector tank 1,2,3 or 4 falls below       *
  *approx. 80 per cent (3,280 kg for tanks *
  *1 and 4; 3,720 for tanks 2 and 3) the   *
  *associated U/FULL caption is illuminated*
  *and after 15 s the jettison valve       *
  *closes.  IF -                           *
  *NOTE:  The NORM - AFT TRIM selector     *
  *       switch must be set to NORM       *
  *       (Ref. 28-22-00).                 *
  ******************************************
                 |
                 |              ----------------------------------
                 |             |1. U/FULL caption is not illumin- |
                 NOT OK--------|   ated as fuel level falls below |
                               |   approx. 80 per cent for tank 1,|
                               |   2,3 or 4, but jettison valve   |
                               |   closes - renew Caption Light   |
                               |   Module (51),(52),(53) or (54). |
                               |2. U/FULL caption is illuminated  |
                               |   as fuel level falls below 80   |
                               |   per cent, but jettison valve   |
                               |   does not operate within 15 s   |
                               |   time delay - renew LH Level    |
                               |   Switching Pack (7), tank 1 or  |
                               |   2, or RH Level Switching Pack  |
                               |   (8), tank 3 or 4.              |
                               |3. U/FULL caption is not illumin- |
                               |   ated and jettison valve does   |
                               |   not operate - Chart 108.       |
                                ----------------------------------
```

CAPTION IS NOT ILLUMINATED AND MASTER WARNING IS NOT ACTIVATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

1

R Renew Caption Light Module (1), (2),(3) or (4). Is fault cleared? —NO— Check for 28 V d.c. output from CB (5) (tanks 1 and 2) or CB (6) (tanks 3 and 4). —YES— Renew Level Switching Pack LH (7), (tanks 1 and (7), (tanks 1 and Switching Pack RH (8), (tanks 3 and 4).

Check for 28 V d.c. output —NO→ Renew CB (5) or (6). Is fault cleared?

Renew CB (5) or (6) —NO→ Check for OC between CB (5) or (6) and Level Pack (7) or (8), or between Level Pack (7) or (8) and Caption Light Module (1),(2), (3) or (4).

Chart 101

R ***'LOW LEVEL' CAPTION NOT ILLUMINATED WHEN FUEL LEVEL IN TANK 1(2,3 or 4) BELOW APPROX. 20 PER CENT.**

NOTE: 2 low level sensors are installed in each of tanks 2 and 3, and both sensors must be uncovered to produce a signal.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

R Check for 28 V d.c. output from CB (5) (tanks 1 and 2) or CB (6) (tanks 3 and 4).

- YES → Renew Level Switching Pack LH (7) (tanks 1 and 2) or Level Switching Pack RH (8) (tanks 3 and 4). Is fault cleared?
  - NO → Renew Probe (9) tank 1, (10) tank 4, (11) or (12) tank 2, (13) or (14) tank 3. Is fault cleared?
    - NO → Check for wiring fault between Probe (9), (11) between Probe (9),(11) or (12) and LH Switching Pack (7), or Probe (10),(13) or (14) and RH Switching Pack (8). Is fault cleared?
      - NO → Check for wiring fault between LH or RH Switching Pack (7) or (8) and Caption Light Module (1),(2),(3) or (4).
- NO → Renew CB (5) or (6).

Chart 102

'O/FULL' CAPTION IS ILLUMINATED WHEN TANK FULL FUEL LEVEL IS REACHED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Check for 28 V d.c. output from CB (15) LH tanks or tank 10, or (16) RH tanks or tank 11.

-YES- Renew Level Switching Pack LH (7) or (RH) (8) as appropriate. Is fault cleared?

-NO-- Renew Probe (17), (11), (13), (18), (19) or (20), (21) (22) or (23), (24) (25), (26), (27), (28), (29), (30), or (31) or (32) as appropriate. Is fault cleared?

NO → Trouble shoot the associated refuelling valve circuit (Ref. 28-24-00, Trouble Shooting).

(From "Check for 28 V d.c. output") NO → Renew CB (15) or (16).

Chart 103

```
*******************************
*'O/FULL' CAPTION IS NOT ILL- *
*UMINATED, AND FUEL IS DIS-   *
*CHARGED THROUGH OVERBOARD    *
*VENT VALVE, DUE TO NON-CLOS- *
*URE OF RCU.                  *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 ----------------         -----------------         -----------------
|Check for 28 V  |       |Renew Level      |       |Renew Probe (17),|
|d.c. output from|-YES- |Switching Pack   |-NO-  |(43) or (44), tank|
|CB (42).        |       |LH (7) or RH (8).|       |1; (11),(45) or  |
 ----------------        |Is fault cleared?|       |(46), tank 2;    |
        |                 -----------------        |(13),(47) or (48),|
        NO                                         |tank 3; (18),(49),|
        |                                          |or (50), tank 4; |
        |                                          |(19) or (20),    |
 -----------------                                 |tank 5; (21)     |
|Renew CB (42).   |                                |tank 6; (22) or  |
 -----------------                                 |(23), tank 7 (24),|
                                                   |tank 5A; (25),   |
                                                   |tank 7A, (26),   |
                                                   |tank 8; fuselage |
                                                   |cell; (27) tank  |
                                                   |(9) left cell, or|
                                                   |(28) right cell; |
                                                   |(29) tank 10 left|
                                                   |cell or (30) right|
                                                   |cell; (31) or    |
                                                   |(32), tank 11.   |
                                                    -----------------
```

Chart 104

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****
*TANKS 5, 7, 9 OR 11 'O/FULL' *
*CAPTION NOT ILLUMINATED WHEN *
*TRIM INLET VALVES SET TO *
*OPEN. *
****

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Check that magnetic indicator shows in-line (valve open).

- YES → Check for 28 V d.c. output from CB (42).
  - YES → Renew Level Switching Pack LH(7) (tank 5 or 9) or Level Switching Pack RH(8) (tank 7 or 11). Is fault cleared?
    - NO → Renew Probe:- (19) or (20) (tank 5); (22) or (23) (tank 7); (27) (tank 9 left cell)or (28) (tank 9 right cell); (31) or (32) (tank 11).
  - NO → Renew CB (42).
- NO → Trouble shoot trim inlet valve circuit (Ref. 28-23-00, Trouble Shooting).

Chart 105

```
**********************************
*TANK 5 OR 7 'O/FULL' CAPTION *
*NOT ILLUMINATED WHEN ASSOCI- *
*ATED TANK 5A or 7A INNER OR  *
*OUTER PUMP SWITCHED ON.      *
**********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 -----------------       -----------------       -----------------
|Is the pump LOW  |     |Check for 28 V   |     |Renew Level      |
|PRESS caption    |-YES-|d.c. output from |-YES-|Switching Pack   |
|extinguished?    |     |CB (42).         |     |LH (7) for tank  |
 -----------------       -----------------      |5, or RH (8) for |
         |                       |              |tank 7. Is fault |
         NO                      NO             |cleared?         |
         |                       |               -----------------
 -----------------       -----------------               |
|Trouble shoot    |     |Renew CB (42).   |              NO
|main transfer    |      -----------------               |
|pump circuit     |                                -----------------
|(Ref. 28-22-00). |                               |Renew Probe (19) |
 -----------------                                |or (20) for tank |
                                                  |5, or (22) or    |
                                                  |(23) for tank 7. |
                                                   -----------------
```

Chart 106

```
********************************        ------------------------------
*TANK 1, 2, 3 or 4 'O/FULL'    *       |GROUND EQUIPMENT REQUIRED     |
*CAPTION NOT ILLUMINATED WHEN  *       |------------------------------|
*REFUEL PANEL DOOR CLOSED.     *       |DESCRIPTION          PART NO. |
********************************       |------------------------------|
                                       |GROUND POWER SUPPLY   -       |
                                       |MULTIMETER            -       |
                                        ------------------------------

 -----------------        -----------------         -----------------
|Check for 115 V  |-NO-|Remove Relay (56) |-YES-|Renew Relay (56).|
|a.c. output from |    |and check for 28 V|      -----------------
|contact A2 of    |    |d.c. output from  |
|test module      |    |socket contact D1 |
|block UT 1854 on |    |of relay base.    |
|RH relay box     |     -----------------
|18-123.          |             |
 -----------------              NO
         |                      |
        YES               -----------------         -----------------
         |               |Apply 28 V d.c. to|--NO-|Renew Relay (57).|
 -----------------       |contact C13 of    |      -----------------
|Renew Refuel     |      |test module block |
|Panel Door       |      |UT 1852 on RH     |
|Microswitch (55).|      |relay box 18-123, |
 -----------------       |and check that    |
                         |Relay (57)        |
                         |operates.         |
                          -----------------
                                  |
                                 YES
                                  |
 -----------------        -----------------         -----------------
|Renew CB (42).   |-NO-|Check for 28 V     |-YES-|Renew Level      |
 -----------------     |d.c. output from   |     |Switching Pack   |
                       |CB (42).           |     |LH (7) (tank 1 or|
                        -----------------        |2) or Level      |
                                                 |Switching Pack RH|
                        -----------------        |(8) (tank 3 or   |
                       |Renew Probe (43)   |-NO--|4). Is fault     |
                       |or (44) (tank 1);  |     |cleared?         |
                       |(45) or (46) (tank|       -----------------
                       |2); (47) or (48)   |
                       |(tank 3); (49) or  |
                       |(50) (tank 4).     |
                        -----------------
```

Chart 107

```
*******************************
*'U/FULL' CAPTION IS NOT ILL- *
*UMINATED AND JETTISON VALVE  *
*DOES NOT OPERATE.            *
*******************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
    -----------------         ----------------         ---------------
   |Check for 28 V    |      |Renew Level     |       |Renew Probe (9) |
R  |d.c. output from  |-YES-|Switching Pack LH|-NO--|tank 1, (10)    |
R  |CB (6) (tanks 1   |      |(7) (tanks 1 and |      |tank 4, (11)    |
R  |and 2), or CB (5) |      |2) or Level      |      |tank 2, or (13) |
   |(tanks 3 and 4).  |      |Switching Pack RH|      |tank 3.         |
    -----------------        |(8) (tanks 3 and |       ---------------
            |                |4). Is fault     |
            NO               |cleared?         |
            |                 ----------------
    -----------------
   |Renew CB (6) or   |
   |(5).              |
    -----------------
```

R Chart 108

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1)Caption light module, tank 1, LOW LEVEL	-	5-214	Q1228	3CM station	28-00-00 R/I	28-42-01
(2)Caption light module, tank 2, LOW LEVEL	-	5-214	Q1233	3CM station	28-00-00 R/I	28-42-01
(3)Caption light module, tank 3, LOW LEVEL	-	5-214	Q1236	3CM station	28-00-00 R/I	28-42-01
(4)Caption light module, tank 4, LOW LEVEL	-	5-214	Q1225	3CM station	28-00-00 R/I	28-42-01
(5)Circuit breaker 28 V, tanks 1 and 2 low level, tanks 3 and 4 underfull	-	1-213	Q1221	Map ref. J16	24-50-00 R/I	28-42-01
(6)Circuit breaker 28 V, tanks 3 and 4 low level, tanks 1 and 2 underfull	-	3-213	Q1221	Map ref. D6	24-50-00 R/I	28-42-01
(7)Level switching pack, LH	-	10-216	Q1350	3CM station	28-42-51 R/I	28-42-05
(8)Level switching pack, RH	-	2-216	Q1351	3CM station	28-42-51 R/I	28-42-07
(9)Probe, UF,LL	-	523	Q1208	No.1 fuel tank	28-44-11 R/I	28-42-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(10)Probe, UF,LL	-	623	Q1207	No.4 fuel tank	28-44-11 R/I	28-42-01
(11)Probe, UF,LL,OF,HL	-	526	Q1129	No.2 fuel tank	28-44-12 R/I	28-44-01
(12)Probe, LL	-	526	Q1130	No.2 fuel tank	28-44-12 R/I	28-44-01
(13)Probe, UF,LL,HL,OF	-	626	Q1143	No.3 fuel tank	28-44-12 R/I	28-44-01
(14)Probe, LL	-	626	Q1144	No.3 fuel tank	28-44-12 R/I	28-44-01
(15)Circuit breaker 28 V, LH tanks and tank 10 HL	-	15-215	Q1218	Map ref. D19	24-50-00 R/I	28-42-01
(16)Circuit breaker 28 V, RH tanks and tank 11 HL	-	15-216	Q1217	Map ref. F8	24-50-00 R/I	28-42-01
(17)Probe, HL,OF	-	523	Q1332	No.1 fuel tank	28-44-11 R/I	28-42-05
(18)Probe, HL,OF	-	623	Q1333	No.4 fuel tank	28-44-11 R/I	28-42-07
(19)Probe HL,OF	-	524	Q1209	No.5 fuel tank	28-44-31 R/I	28-42-05
(20)Probe, HL,OF	-	524	Q1335	No.5 fuel tank	28-44-31 R/I	28-42-05
(21)Probe, HL,OF	-	525	Q1337	No.6 fuel tank	28-44-33 R/I	28-42-05
(22)Probe, HL,OF	-	625	Q1103	No.7 fuel tank	28-44-33 R/I	28-44-03
(23)Probe, HL,OF	-	625	Q1400	No.7 fuel tank	28-44-33 R/I	28-42-07

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(24)Probe, HL,OF	-	527	Q1336	No.5A fuel tank	28-44-32 R/I	28-42-05
(25)Probe, HL,OF	-	524	Q1335	No.7A fuel tank	28-44-32 R/I	28-42-05
(26)Probe, HL,OF	-	143/144	Q1119	No.8 fuel tank	28-44-31 R/I	28-44-03
(27)Probe, HL,OF	-	521	Q1132	No.9 fuel tank left cell	28-44-51 R/I	28-44-04
(28)Probe, HL,OF	-	621	Q1139	No.9 fuel tank right cell	28-44-51 R/I	28-44-04
(29)Probe, HL,OF	-	522	Q1163	No.10 fuel tank	28-44-52 R/I	28-44-04
(30)Probe, HL,OF	-	622	Q1162	No.10 fuel tank	28-44-52 R/I	28-44-04
(31)Probe, HL,OF	-	311	Q1168	No.11 fuel tank	28-44-71 R/I	28-44-05
(32)Probe, HL,OF	-	311/312	Q1401	No.11 fuel tank	28-44-71 R/I	28-42-07
(33)Caption light module, tank 1, O/FULL	-	5-214	Q1226	3CM station	28-00-00 R/I	28-42-05
(34)Caption light module, tank 2, O/FULL	-	5-214	Q1231	3CM station	28-00-00 R/I	28-42-05
(35)Caption light module, tank 3, O/FULL	-	5-214	Q1234	3CM station	28-00-00 R/I	28-42-05
(36)Caption	-	5-214	Q1223	3CM	28-00-00	28-42-07

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ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
light module, tank 4, O/FULL				station	R/I	
(37)Caption light module, tank 5, O/FULL	-	5-214	Q1229	3CM station	28-00-00 R/I	28-42-05
(38)Caption light module, tank 7, O/FULL	-	5-214	Q1230	3CM station	28-00-00 R/I	28-42-07
(39)Caption light module, tank 9, O/FULL	-	2-214	Q1222	3CM station	28-00-00 R/I	28-42-05
(40)Caption light module, tank 11, O/FULL	-	5-214	Q1237	3CM station	28-00-00 R/I	28-42-05
(41)Caption light module, O/FULL	-	1-194	Q541	Refuel control panel	28-00-00 R/I	28-42-05
(42)Circuit breaker 28 V, OF sup. and indication	-	3-213	Q1219	Map ref. D5	24-50-00 R/I	28-42-05
(43)Probe, OF	-	523	Q1121	No.1 fuel tank	28-44-11 R/I	28-44-01
(44)Probe, OF	-	523	Q1123	No.1 fuel tank	28-44-11 R/I	28-44-01
(45)Probe, OF	-	526	Q1128	No.2 fuel tank	28-44-12 R/I	28-44-01
(46)Probe, OF	-	526	Q1131	No.2 fuel tank	28-44-12 R/I	28-44-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(47)Probe, OF	-	626	Q1142	No.3 fuel tank	28-44-12 R/I	28-42-07
(48)Probe, OF	-	626	Q1145	No.3 fuel tank	28-44-12 R/I	28-44-01
(49)Probe, OF	-	623	Q1125	No.4 fuel tank	28-44-11 R/I	28-44-01
(50)Probe, OF	-	623	Q1127	No.4 fuel tank	28-44-11 R/I	28-44-01
(51)Caption light module, tank 1, U/FULL	-	5-214	Q1227	3CM station	28-00-00 R/I	28-42-03
(52)Caption light module, tank 2, U/FULL	-	5-214	Q1232	3CM station	28-00-00 R/I	28-42-03
(53)Caption light module, tank 3, U/FULL	-	5-214	Q1235	3CM station	28-00-00 R/I	28-42-03
(54)Caption light module, tank 4, U/FULL	-	5-214	Q1224	3CM station	28-00-00 R/I	28-42-03
(55)Refuel panel door microswitch	-	194	Q548	Refuel panel 1-194	28-24-61 R/I	28-24-01
(56)Ground/ flight control relay	-	18-123	Q599	RH fuel relay box, fwd. u/floor equip. racking	28-00-00 R/I	28-24-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(57)O/F inhibit relay	-	18-123	Q600	RH fuel relay box, fwd. u/floor equip. racking	28-00-00 R/I	28-24-01

Component Identification
Table 101

FUEL LEVEL INDICATION - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00, AND THE FUEL SAFETY PRECAUTIONS DETAILED IN 12-11-28 AND 28-10-00.

1. General

The Operational Test detailed in this topic verifies the functioning of a level switching pack, following its replacement in the system. It is assumed that all tank fuel contents are below high-level.

The Functional Test verifies the operation of the fuel level indication system in detail, including the switching functions of the level switching packs. To perform this test it may be necessary to partially defuel certain tanks, and transfer fuel between tanks, to bring the fuel in the required tank to a level compatible with the switching/controlling action of the associated level pack. As the left and right side fuel tankage is similar, the instructions detailed are applicable to both sides. Any fuel movement must be controlled carefully to maintain the aircraft balance and ground attitude.

A System Test is not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Test the LOW LEVEL, U/FULL and O/FULL caption filaments as detailed in 33-14-00.

B. Test

(1) Refer to the fuel management panels 2-214 and 5-214 at the 3CM station.

(2) On panel 5-214 press and release each LOW LEVEL caption, in turn, for tanks 1, 2, 3 and 4, and check that the caption is illuminated, accompanied by an amber FUEL master warning and a single-stroke gong, then extinguished, and the master warning cancelled.

(3) Trip the O/FULL SUP & IND supply circuit breaker Q1219, map ref.D5, on panel 3-213, and allow 1 min to elapse.

R (4) On the fuel management panels set the trim valve selector switches for tanks 5, 7, 9 and 11 to "OPEN" (Ref. 28-23-00).

R (5) Reset the circuit breaker tripped in operation (3) and check that the tank O/FULL captions for tanks 1, 2, 3, 4, 5, 7, 9 and 11 are illuminated, then extinguished.

R (6) Close the trim valves.

R (7) On the ground refuel panel, 1-194, set the refuel master switch to "REFUEL", and the tank 5A refuel valve control switch to "OPEN", with all the remaining refuel valves set to SHUT.

R (8) Refer to operation (3); trip circuit breaker Q1219, and allow 1 min to elapse.

R (9) Reset circuit breaker Q1219 and check that the TANK O/F caption on the refuel panel is illuminated, then extinguished.

R (10) Repeat operations (8) and (9) for each of the remaining tanks in turn.

R (11) Set the refuel master switch to "SET UP" and all the refuel valves to "OPEN"; verify that the valve position indicators all show yellow.

R (12) Press the REFUEL VALVE SHUT OFF CHECK push-switch and check that all the refuel valves are closed, with the indicators showing black.

R (13) Release the push-switch and check that the valves run open, and the indicators show yellow.

R (14) Set the refuel valves to "CLOSE" (indicators black), and the refuel master switch to "OFF".

R NOTE: This test does not confirm the operation of the U/FULL captions for the collector tanks. These must be checked as detailed in the Functional Test, paragraphs 3.B.(15) and (16), or during the next aircraft flight.

R C. Conclusion

R (1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) If necessary, prepare the aircraft for refuelling/defuelling as detailed in 28-24-00 and 28-25-00.

(3) Test the LOW LEVEL, U/FULL and O/FULL caption filaments as detailed in 33-14-00.

B. Test

(1) Refer to the fuel management panels 2-214 and 5-214 at the 3CM station.

(2) On panel 5-214 press and release each LOW LEVEL caption, in turn, for tanks 1, 2, 3 and 4, and check that the caption is illuminated, accompanied by an amber FUEL master warning and a single-stroke gong, then extinguished and the master warning cancelled.

(3) Ensure that the fuel level in tank 1 (2, 3 or 4) is below approx. 20 per cent tank volume (800 kg, tanks 1 and 4; 930 kg, tanks 2 and 3), to activate the low level sensors.

(4) Check that the associated LOW LEVEL caption is illuminated, accompanied by an amber FUEL master warning and single-stroke gong.

(5) Transfer fuel into the tank under test (Ref. 28-22-00); as the fuel level rises check that the LOW LEVEL caption is extinguished and the master warning is cancelled.

NOTE: The trim valves in tanks 5, 7, 9 and 11 must be closed, and the inner and outer pumps in tanks 5A and 7A must be switched off.

(6) Open the appropriate refuel valve(s) for tank 1 (2, 3, 4, 5, 6, 7, 8, 9, 10 or 11), then commence refuelling the tank under test.

R (7) When the refuel valve closes, through the switching
R action of the associated high level sensor, stop the
R refuelling.

R (8) Transfer a sufficient quantity of fuel from the tank

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to re-open the refuel valve, denoted by the position indicator showing yellow.

(9) Trip the appropriate tank refuel valve supply circuit breaker (LH inlet valve main supply for tank 11) to prevent the valve from closing; fit a safety clip.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 1 REFUEL VALVE SUP	15-215	Q522	E23
TANK 2 REFUEL VALVE SUP	15-216	Q524	F10
TANK 3 REFUEL VALVE SUP	15-216	Q523	F3
TANK 4 REFUEL VALVE SUP	15-215	Q521	E24
TANK 5 REFUEL VALVE SUP	15-215	Q518	E25
TANK 6 REFUEL VALVE SUP	15-215	Q520	F20
TANK 7 REFUEL VALVE SUP	15-215	Q517	F21
TANK 8 REFUEL VALVE SUP	15-215	Q519	F19
TANK 9 REFUEL VALVE SUP	15-216	Q515	F9
TANK 10 REFUEL VALVE SUP	15-215	Q516	E22
TANK 5A REFUEL VALVE SUP	15-216	Q526	F4
TANK 7A REFUEL VALVE SUP	15-216	Q525	F5
TANK 11 LH INLET VALVE MAIN SUP	15-215	Q365	G21

(10) Continue filling the tank, and check that at the tank overfull fuel level the associated O/FULL caption is illuminated, and the refuel control unit (RCU) shuts to stop the refuel operation.

(11) Check that the RCU visual indicator shows FAILED.

NOTE: The TANK O/F caption on the refuel panel must be illuminated in this situation.

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For tanks 6, 8 and 10 visual indication is by means of the TANK O/F caption on the refuel panel.

R (12) Reset the circuit breaker tripped in operation (9) and check that the refuel valve closes, denoted by the valve position indicator showing black.

R (13) Check that the appropriate O/FULL caption on the fuel management panel and the refuel panel TANK O/F caption are extinguished.

R (14) Rotate the RCU control handle until the visual indicator shows SHUT, then OPEN.

R (15) Open and close the trim inlet valves for tank 5, 7, 9 and 11 in turn (Ref. 28-23-00) and check that the associated tank O/FULL caption is illuminated, then extinguished. Ensure that the manual selection is done in the correct sequence.

NOTE: When the fuel is at high level or above, the associated inlet valve will not open when the INLET VALVES MAIN switch is set to OPEN, but will operate when the O/RIDE switch is set to OPEN.

R (16) Switch on and off an inner, then an outer pump switch for tank 5A (7A) (Ref. 28-22-00) and check that the associated O/FULL caption for tank 5 (7) is illumiated, then extinguished.

R (17) Close the refuel panel access door 1-194.

R (18) On the fuel management panel check that the O/FULL captions for tanks 1, 2, 3 and 4 are illuminated, but for all the remaining tanks are extinguished.

R (19) Open the refuel panel access door, and check that all the O/FULL captions on the refuel panel and the fuel management panels are extinguished.

NOTE: During flight, provided all trim valves are shut and tanks 5A and 7A pumps are switched off, all tank O/FULL captions are inhibited. However, the inhibition for tanks 1, 2, 3 and 4 is overridden to give a tank overfull indication if a main transfer control valve fails to close.

R After SB 28-016, Part A, if the fuel level in

R tank 11 reaches overfull, the associated O/FULL caption is illuminated, even if the trim inlet valves are closed, signifying the possible fracture of a trim inlet pipe.

R (20) Transfer a sufficient quantity of fuel from the tank to restore the contents to the high level state. Verify this condition by checking that the refuel valve position indicator shows yellow (valve open).

R (21) Top up the tank as necessary to close the refuel valve (indicator black).

R (22) Operate the collector tank (1, 2, 3 or 4) jettison valves as detailed in 28-31-00, Adjustment/Test (Functional Test - Auto Shut-off), and check that as the tank contents fall below approx. 80 per cent (3,280 kg for tanks 1 and 4; 3,720 kg for tanks 2 and 3) the U/FULL caption is illuminated, and after 15 s the jettison valve closes, signalled by the magnetic indicator.

R (23) Refill the tank and check that when the fuel level rises above approx. 80 per cent, the U/FULL caption is extinguished.

R (24) Verify the fuel transfer valve switching function of the tank high level sensors and level switching packs, by transferring fuel as detailed in 28-22-00, Adjustment/Test.

NOTE: For tanks 5A and 7A the valves are closed automatically, provided the associated pumps are operating.

R (25) Verify the tank high level switching control function for the trim tank valves as detailed in 28-23-00, Adjustment/Test.

C. Conclusion

(1) Set the refuel panel master switch to "OFF".

(2) Disconnect and remove the refuelling equipment, and close the refuel panel access door as detailed in 12-11-28.

(3) Switch off and disconnect electrical ground power as detailed in 24-41-00.

LEVEL SWITCHING PACKS - REMOVAL/INSTALLATION

R WARNING: DO NOT REMOVE THE COVER FROM A PACK UNDER ANY
R CIRCUMSTANCES.

OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Two level switching packs, housed in 1/4 ATR short cases, are located at the third crew member's (3CM) station. The right switching pack is mounted on shelf 2-216, and the left is mounted on shelf 10-216, in the RH equipment racking.

2. Level Switching Pack

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare

(1) Electrically isolate the switching pack to be removed by tripping the associated circuit breakers; fit safety clips.

(2) Remove the appropriate cover from the RH racking and identify the unit to be removed.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH switching pack			
TANKS 3 & 4 UF TANKS 1 & 2 LL SUP & IND	1-213	Q1221	J16
TANK 3 JET VALVE SUP	1-213	Q133	L11
O/FULL SUP & IND	3-213	Q1219	D5

	SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R	TANKS 1 & 2 UF	3-213	Q1220	D6
R	TANKS 3 & 4 LL			
R	SUP & IND			
R	LH TANKS & TANK	15-215	Q1218	D19
R	10 HIGH LEVEL SUP			
R	TANK 4 JET VALVE	15-215	Q134	D20
R	SUP			
R	TANK 9 RH INLET	15-216	Q362	D4
R	VALVE MAIN SUP			
R	SCAVENGE PUMP	15-216	Q493	C6
R	CONT & IND			
R	TANK 7A-7 TRANS	15-216	Q6669	F7
R	VALVE SUP & IND			
R	TANK 7A PUMPS IND	15-216	Q892	A7
R	LH switching pack			
R	OVERFLOW RELIEF	1-213	Q721	K15
R	VALVE SUP & IND			
R	TANKS 3 & 4 UF	1-213	Q1221	J16
R	TANKS 1 & 2 LL			
R	SUP & IND			
R	TANK 1 JET VALVE	3-213	Q131	C7
R	SUP			
R	TANK 1 & 2 UF	3-213	Q1220	D6
R	TANKS 3 & 4 LL			
R	SUP & IND			
R	TANK 9 LH INLET	15-215	Q361	G19
R	VALVE MAIN SUP			
R	TANK 5A PUMPS IND	15-215	Q891	C23
R	LH TANKS & TANK	15-215	Q1218	D19
R	10 HIGH LEVEL SUP			

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK 5A-5 TRANS VALVE SUP & IND	15-215	Q6668	G24
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F8

C. Remove

(1) Disconnect the electrical connectors from the forward end of the pack.

(2) Loosen the clamping nut and swing the securing screw assembly clear of the unit hold-down hook.

(3) Grasp the carrying handle and withdraw the switching pack from the backplate connector; remove the unit from the shelf.

D. Install

(1) Comply with the electrical safety precautions.

(2) Ensure that the mating surfaces of the electrical connectors are clean and undamaged.

(3) Position the switching pack on the shelf runners, then slide the unit rearward until the backplate connector is engaged fully.

(4) Engage the securing screw assembly with the switching pack hold-down hook, and secure it with the clamping nut; ensure that the unit is bonded in accordance with 20-27-11.

R CAUTION: BEFORE SB 28-026, AFTER THE FOLLOWING OPERATION (5) THE COINCIDENCE OF THE ELECTRICAL PLUG AND RECEPTACLE IDENTIFICATION MUST BE CONFIRMED BY DUPLICATE INSPECTION, SINCE CROSS-CONNECTION IS POSSIBLE.

(5) Connect the electrical connectors to the forward end of the pack, ensuring that the connections are made in accordance with the connector identification and the applicable wiring diagram.

(6) Refit and secure the racking cover.

E. Conclusion

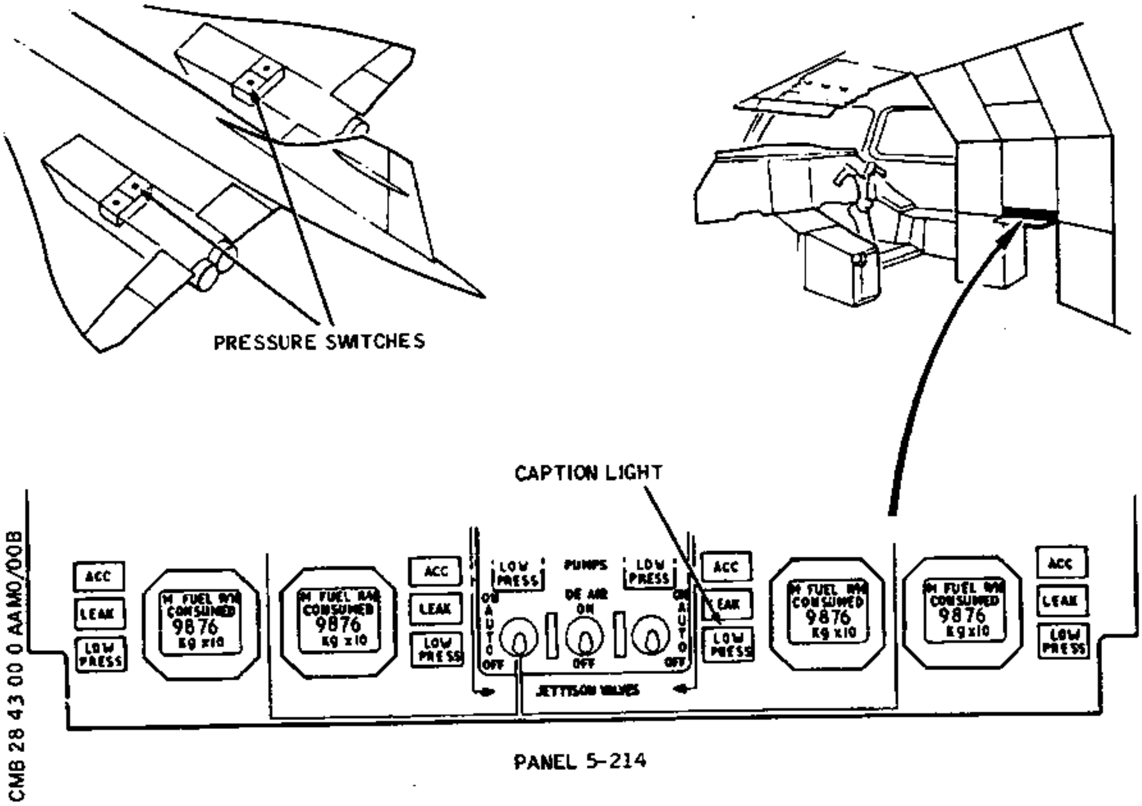
(1) Remove the safety clips and reset the circuit breakers tripped before removal.

R (2) Perform an Operational Test of the system (Ref. 28-42-00, Adjustment/Test).

R ENGINE FEED LOW PRESSURE INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The fuel feed to each engine is provided with a low pressure warning system, to signal any unacceptable fuel pressure loss. A pressure switch is installed in each engine feed pipe at the engine dry bay/nacelle heatshield junction, and is connected electrically to an amber LOW PRESS caption on the lower fuel management panel 5-214, at the third crew member's (3CM) station. Each caption is provided with press-to-test and dimming facilities.



- Location of Pressure Switches and Caption Lights
Figure 001

2. Pressure Switch

The pressure switch is a simple diaphragm-operated microswitch in which a sealed capsule is connected by linkage to the normally-closed switch contacts. Movement of the diaphragm is transmitted through the linkage to operate the micro-switch.

3. Operation

A. Functional Description

NOTE: As the four engine systems are similar only one system as described.

Due to the pressure switch operational setting being 13.5(±1.0) psia, which is critically close to standard atmospheric pressure at sea level, unless the aircraft is located on a high altitude airfield, the switch
R contacts are normally open. In this situation, with the fuel system static, and electrical power supplies connected, the associated caption will not normally be illuminated. If the caption is illuminated it will be extinguished immediately the main engine fuel feed pump is switched on. During flight if the pressure in the engine feed pipe falls below the switch setting, with the possibility of pump cavitation, the LOW PRESS caption is illuminated, accompanied by an amber FUEL master warning and a single-stroke gong.

During system operation the caption press-to-test facility can be used to verify the function of the caption light and the master warning system.

B. Electrical Power Supplies

Electrical power supplies for the Nos.1 and 3 engine feed low pressure warning systems are taken from the 'A' main 28 V d.c. busbar, and for the Nos.2 and 4 systems from the 'B' main 28 V d.c. busbar.

R ENGINE FEED LOW PRESSURE INDICATION - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

The four engine feed low pressure warning circuits are similar, therefore the procedures and charts are applicable to all four. Where identical components are involved, that is, one in each circuit, all references to the associated components listed in Table 101 are given, for example, 'Renew Circuit Breaker (1), (2), (3) or (4)'.

2. Preparation

NOTE: As the operating pressure of the pressure switches is critically close to standard atmospheric pressure at sea level, the associated captions may or may not be illuminated, depending on the actual switch setting (13.5(±1.0) psia), barometric pressure, or the altitude of the airfield. A suspect pressure switch must be removed for laboratory testing, and a new switch fitted.

A. Ensure that the associated circuit breakers are set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Gain access to the engine dry bay, No.1, 2, 3 or 4, as appropriate.

3. Trouble Shooting

A. Prepare to trouble shoot (Ref. para.2.). With the appropriate No.1, 2, 3 or 4 engine collector tank LP valve switch set to OPEN, and the main engine feed pump running (Ref. 28-21-00), check that, if illuminated, the associated LOW PRESS caption is extinguished immediately the pump is switched on. IF -

- NOT OK — Caption slow to be extinguished, extinguished intermittently, or not at all - Chart 101.
- OK — go to B.

B. Check that LOW PRESS caption is illuminated when ambient pressure is below min. switch setting, then switch off feed pump and check that, with falling pressure, caption is illuminated (with engine running). IF -

- NOT OK — LOW PRESS caption not illuminated - Chart 102.

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WITH FEED PUMP SWITCHED ON, CAPTION SLOW TO BE EXTINGUISHED, EXTINGUISHED INTERMITTENTLY, OR NOT AT ALL.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

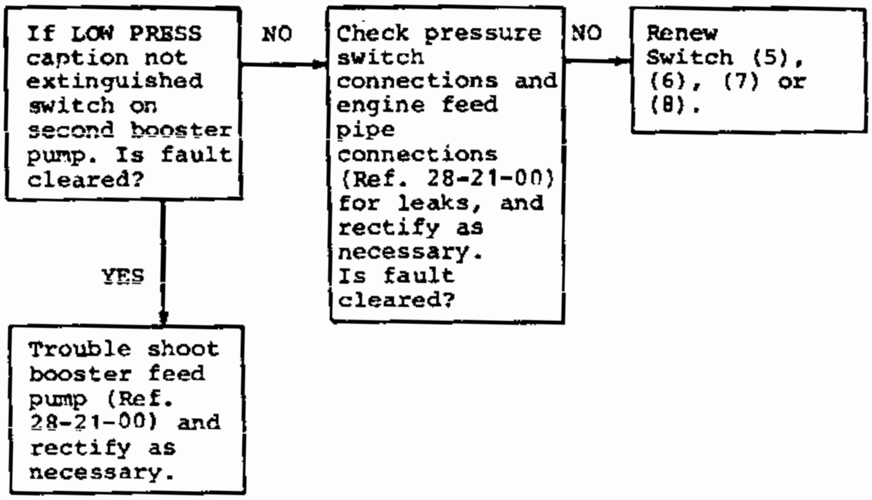

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Chart 101

LOW PRESS CAPTION NOT ILLUMINATED WHEN AMBIENT PRESSURE BELOW MIN. SWITCH SETTING OR CAPTION NOT ILLUMINATED WITH FALLING PRESSURE WHEN FEED PUMP SWITCHED OFF WITH ENGINE OPERATING (IF ILLUMINATED WHEN STATIC).

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

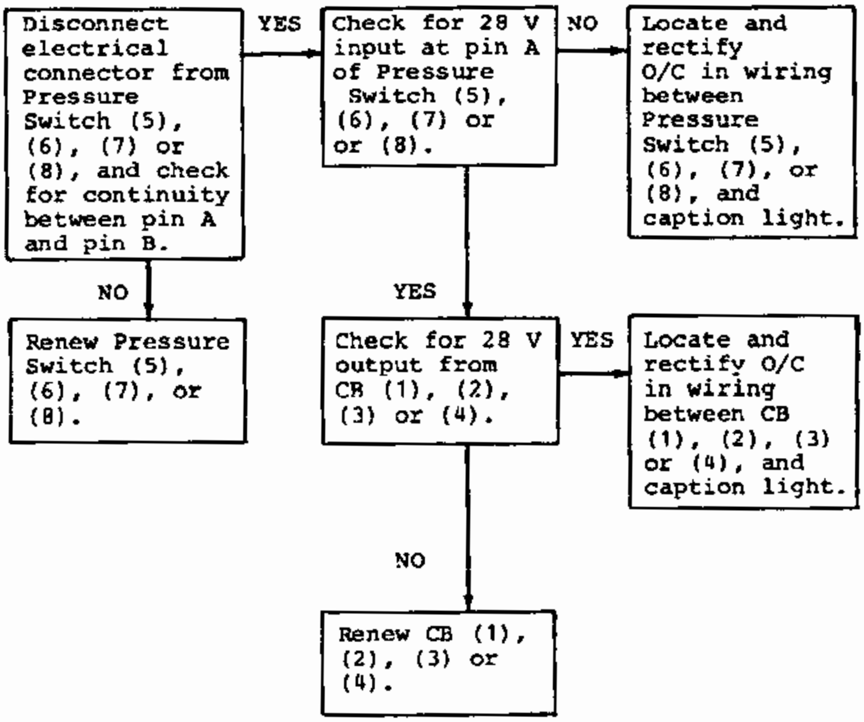

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Chart 102

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1) Circuit breaker 28 V (No.1 engine)	-	15-215	1Q461	Map ref. D24	24-50-00 R/I	24-52-11
(2) Circuit breaker 28 V (No.2 engine)	-	15-216	2Q461	Map ref. E1	24-50-00 R/I	24-52-12
(3) Circuit breaker 28 V (No.3 engine)	-	15-215	3Q461	Map ref. D25	24-50-00 R/I	24-52-11
(4) Circuit breaker 28 V (No.4 engine)	-	15-216	4Q461	Map ref. E2	24-50-00 R/I	24-52-12
(5) Pressure switch (No.1 engine)	532 CT	-	1Q463	No.1 dry bay	28-43-11 R/I	28-43-11
(6) Pressure switch (No.2 engine)	531 BT	-	2Q463	No.2 dry bay	28-43-11 R/I	28-43-11
(7) Pressure switch (No.3 engine)	631 BT	-	3Q463	No.3 dry bay	28-43-11 R/I	28-43-11
(8) Pressure switch (No.4 engine)	632 CT	-	4Q463	No.4 dry bay	28-43-11 R/I	28-43-11

Component Identification
Table 101

R ENGINE FEED LOW PRESSURE INDICATION - ADJUSTMENT/TEST

1. General

This Operational Test proves the integrity of the engine feed low pressure warning system. Functional and System Tests are not considered necessary in this application.

2. Operational Test

NOTE: As the settings of the pressure switches are critically close to standard atmospheric pressure at sea level, when electrical power is made available the associated LOW PRESS caption may or may not be illuminated, depending on the actual switch setting (13.5(±1.0) psia), barometric pressure, and the altitude of the airfield.

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Refer to the lower fuel management panel 5-214 at the 3CM station. If the four LOW PRESS captions at the bottom of the panel are illuminated, proceed as follows:

(a) Trip the appropriate circuit breakers to isolate the Nos. 2, 3 and 4 engine systems.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Engine feed low pressure			
No.1 engine	15-215	1Q461	D24
No.2 engine	15-216	2Q461	E1
No.3 engine	15-215	3Q461	D25
No.4 engine	15-216	4Q461	E2

(b) Check that the No.1 amber FUEL master warning is illuminated.

(c) Check that the No.1 tank LP valve switch is set to OPEN, then switch "ON" the No.1 main engine feed pump (Ref. 28-21-00), and check that the LOW PRESS caption (Ref. operation (1)) is extinguished immediately the pump is switched on.

(d) With the feed pump still operating, press the LOW PRESS caption and check that the caption is illuminated, accompanied by the FUEL master warning and a single-stroke gong.

(e) Release the caption and check that it is extinguished and the master warning is cancelled.

(f) Switch the feed pump "OFF" and check that the LOW PRESS caption is illuminated as the fuel pressure falls, accompanied by the FUEL master warning and the single-stroke gong.

(g) Trip the No.1 engine circuit breaker.

(2) Reset the appropriate circuit breaker and repeat operations (1)(b) to (f) for Nos.2, 3 and 4 systems in turn. Trip the circuit breaker at the termination of each system test.

(3) Reset the four circuit breakers.

(4) If the four LOW PRESS captions are not illuminated, press each caption in turn and check that the caption is illuminated, accompanied by an amber FUEL master warning and a single-stroke gong, then release the caption.

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

PRESSURE SWITCH (ENGINE INLET) - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General (Ref. Fig. 401)

The engine inlet fuel pressure switch for each engine fuel feed system is located in the wing dry bay area, above the associated engine.

2. Pressure Switch

A. Equipment and Materials

	DESCRIPTION	PART NO.
	Circuit breaker safety clip	-
R	Access panel key	E920132000

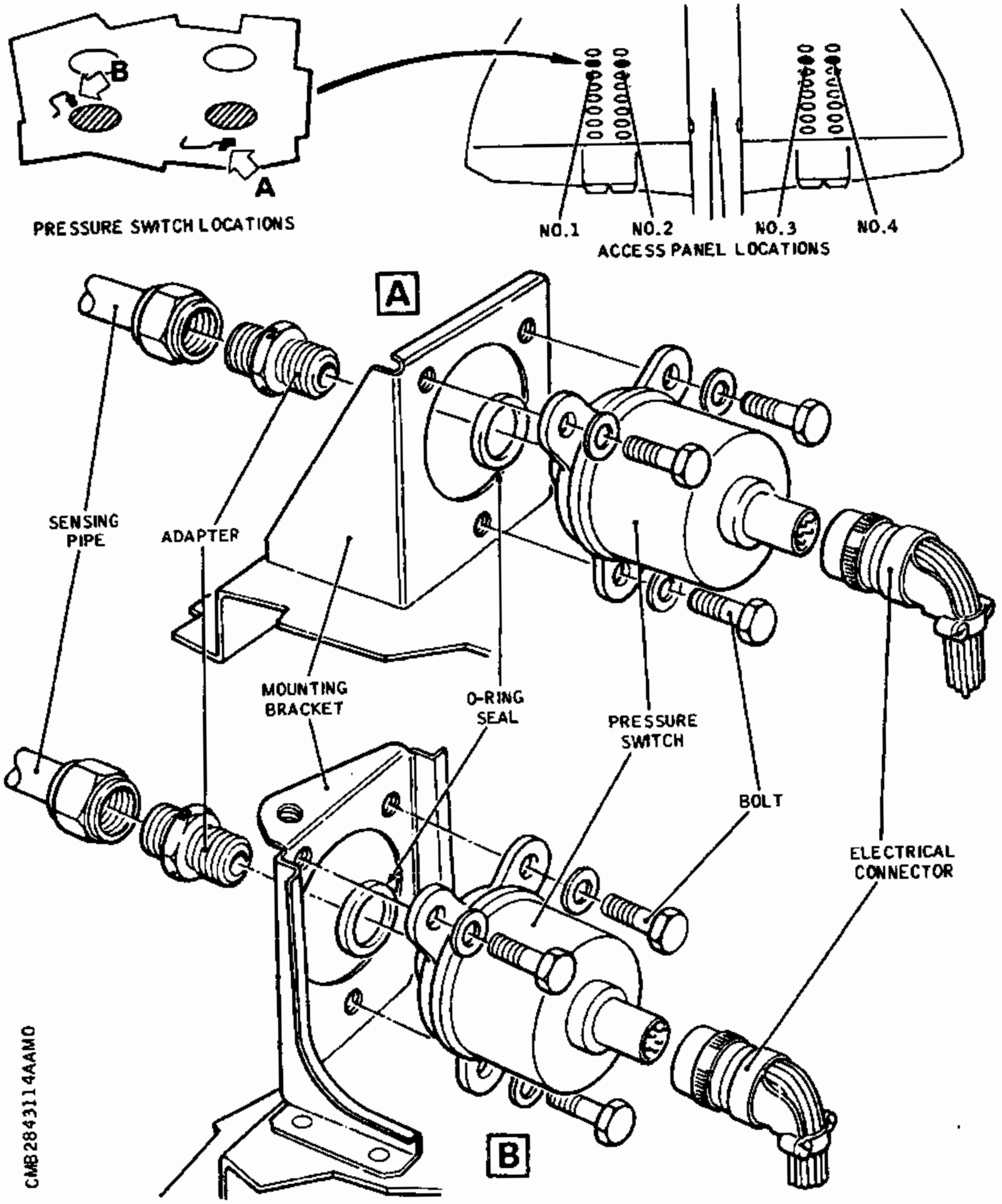
B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Refer to the lower fuel management panel 5-214 at the 3CM station, and set the guarded LP VALVE switch for the associated engine system to "SHUT 1".

(3) Electrically isolate the pressure switch to be removed by tripping the appropriate circuit breaker.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
LP indication			
No.1 engine	15-215	1Q461	D24
No.2 engine	15-216	2Q461	E1



Pressure Switch - Installation
Figure 401

No.3 engine	15-215	3Q461	D25
No.4 engine	15-216	4Q461	E2

(4) Using the key, unlock and remove the appropriate wing access panel listed in Table 401.

PRESSURE SWITCH LOCATION	ZONE/ACCESS PANEL
No.1 engine bay	532 CT
No.2 engine bay	531 BT
No.3 engine bay	631 BT
No.4 engine bay	632 CT

Pressure Switch Location and Access Panel
Table 401

C. Remove

(1) Identify the switch to be removed and disconnect the electrical connector.

(2) Disconnect the fuel pressure sensing pipe from the switch; fit blanks to the pipe union nut and the pipe adapter.

NOTE: As the bottom switch securing bolt is used for bonding purposes it should be identified before removal.

(3) Remove the securing bolts from the switch mounting bracket, and withdraw the switch.

(4) Remove the pipe adapter from the switch and fit a blank to the orifice; discard the O-ring seal.

D. Install

(1) Comply with the electrical and fuel safety precautions.

(2) Moisten a new O-ring seal with fuel, and with the

seal interposed between the pipe adapter and the switch, screw the adapter into the threaded orifice in the switch body; torque-tighten the adapter to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(3) Refer to the NOTE following paragraph 2.C.(2). and identify the special (bonding) securing bolt.

(4) Secure the switch to the mounting bracket with the bolts and washers; ensure that the bonding bolt is in the bottom location, and that the switch is bonded correctly in accordance with 20-27-11. Torque-tighten the bolts to between 40 and 45 lbf in (0.45 and 0.51 mdaN).

(5) Secure the pressure sensing pipe to the adapter; using a spanner to support the adapter, torque-tighten the union nut to between 40 and 65 lbf in (0.45 and 0.73 mdaN).

(6) Connect the electrical connector to the switch, ensuring that the mating surfaces are clean and undamaged.

(7) Ensure that electrical ground power is still available.

(8) On panel 5-214 set the appropriate LP VALVE switch to "OPEN", and lock it in this position with the switch guard.

E. Conclusion

(1) Reset the circuit breaker tripped before switch removal.

(2) Perform an Operational Test of the engine LP fuel feed system as detailed in 28-43-00, Adjustment/ Test.

(3) Ensure that there are no fuel leaks from the switch connections.

(4) At the conclusion of a satisfactory test, refit and lock the wing access panel.

(5) Switch off and disconnect electrical ground power as detailed in 24-41-00.

FUEL QUANTITY INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

The fuel quantity indication (FQI) system comprises a number of individual gauging channels, through which information is relayed from the fuel tanks to contents indicators on the upper and lower fuel system management panels at the third crew member's (3CM) station during flight, or alternatively to indicators on the ground refuel panel during refuelling operations.

Gauging information is also utilized to provide:-

(1) Total fuel indication on the pilot's dash panel, and on the system management and refuel panels.

(2) Load limit control (LLC) for refuelling and trim transfer operations.

(3) Data for computation of the aircraft centre of gravity (c.g. or CG) and permissible mach limits.

(4) Indication of c.g. and mach number - c.g., visual and audio warnings.

A typical gauging channel includes one or more capacitance-type probes, an amplifier network and separate flight and ground refuel contents indicators. The channels between the trim tanks 9, 10 and 11, and the associated flight contents indicators are duplicated to ensure continuous quantity indication in the event of a single channel failure. More than one probe is installed in each tank to maintain gauging accuracy over a wide range of aircraft attitudes. The probes are connected by a tank harness to a common outlet plug in the tank wall, from where the probe signals are applied to the associated amplifier network.

Original information from the probes is fed into two electronic fuel quantity packs, A (LH) and B (RH), through which the gauging channels are routed. A change-over relay is interposed between each amplifier network and the pack output plug, which is connected to the associated flight and refuelling contents indicators.

From the flight and refuelling contents indicators, the gauging channels are extended to connect repeater signals to an amplifier network in a further electronic pack; this is the main c.g. pack. Apart from gauging information, this pack, together with two additional packs, the standby 1 and standby 2 c.g. packs, receives signals in respect of

aircraft weight and c.g. datum, as well as signals from the air data computers.

The aircraft characteristics are such that the aerodynamic centre moves substantially between subsonic and supersonic flight. As a result it is necessary to maintain the aircraft c.g. relative to mach number, to provide adequate stability and manoeuvrability under all conditions, with minimum drag. This is achieved, automatically, by transferring fuel forward or rearward as necessary, to adjust the contents of the trim tanks. The c.g., relative to the mach number, is displayed to the pilots and the 3CM, on separate c.g. indicators, on the pilots' instrument panel and the upper fuel management panel.

The aircraft c.g. position is expressed as a percentage of the wing aerodynamic reference chord (Co), the forward datum of the chord being defined as 0 per cent. For take-off the requirement is that the aircraft c.g. position is approximately 53.5 per cent Co; thereafter for the remainder of the flight, it should be controlled to follow a defined c.g. corridor (relative to mach number), with a c.g. position of approximately 59 per cent for supersonic cruise and 53 per cent for landing. C.g. limits are displayed, by separate pointers, on the pilot's and co-pilot's machmeters.

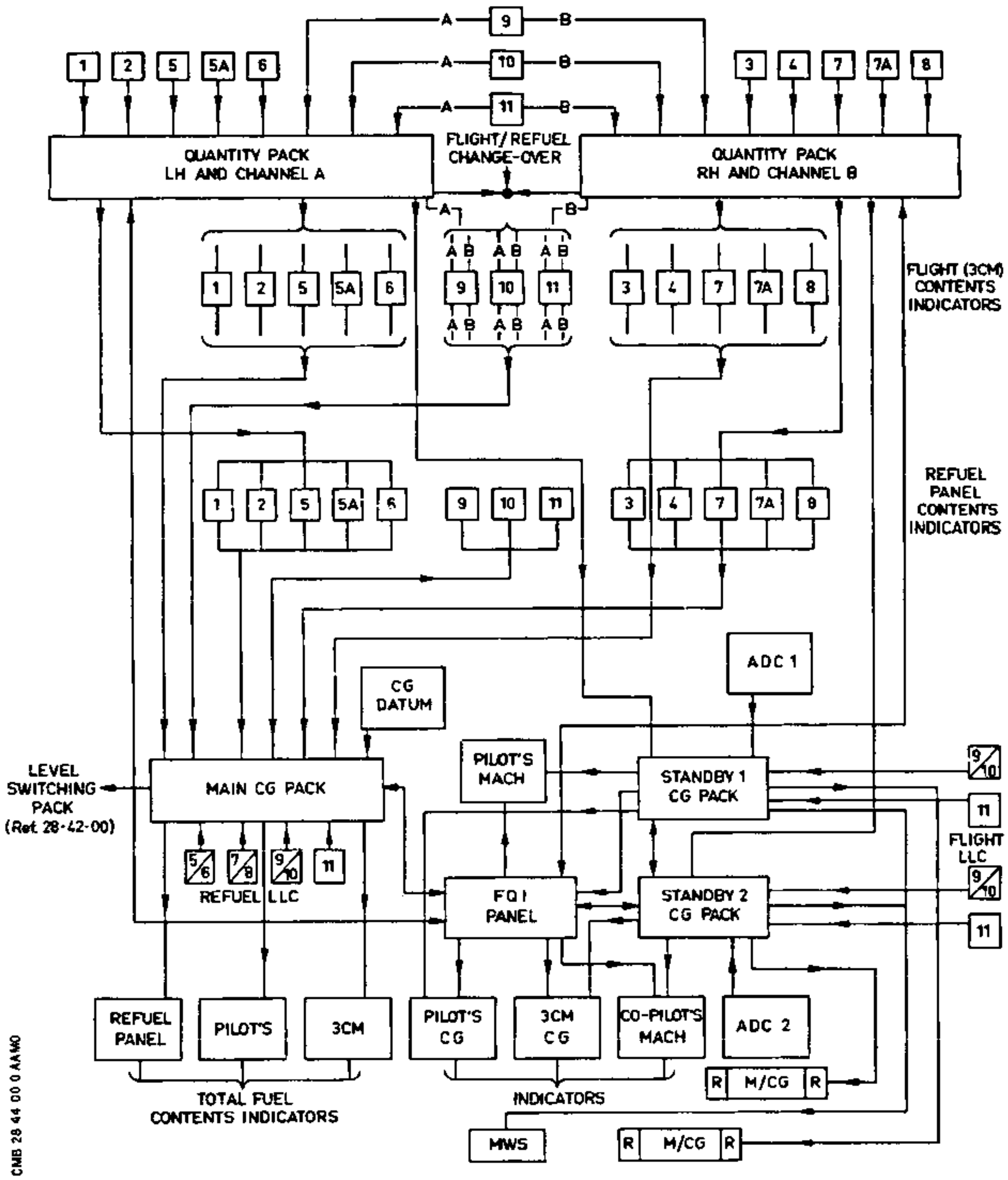
R A toggle switch, engraved T/O CG, on panel 1-214 at the
R 3CM station, provides a take-off c.g. override facility,
R to permit the No.11 tank fuel capacity to be increased.

Test facilities for the FQI system, including the c.g. component, are provided on the FQI control panel, located on the lower fuel management panel.

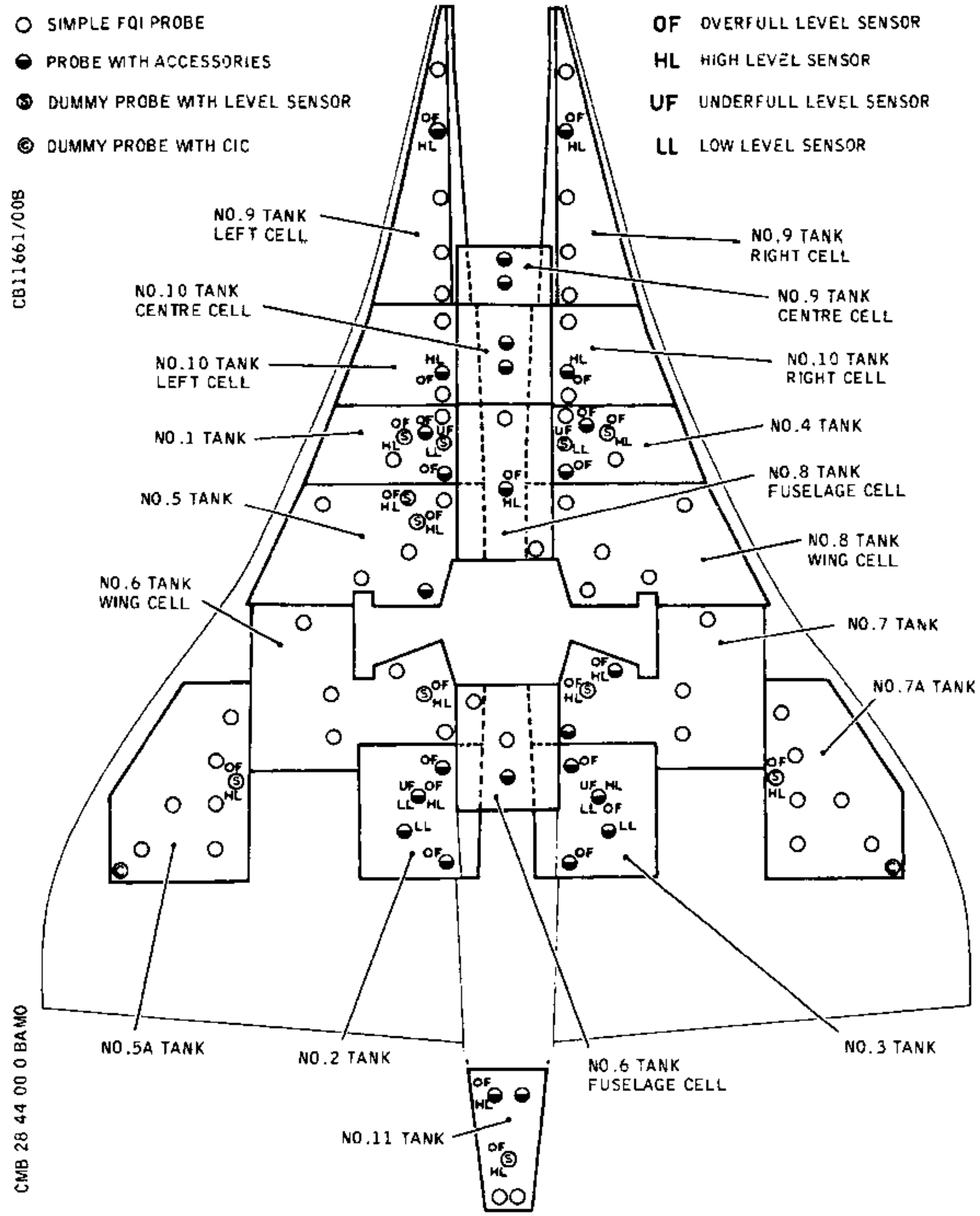
2. Probes (Ref. Fig. 002)

Each probe consists of two concentric tubes with a silver coating on the facing surfaces. Connections from the aircraft electrical supply are made to the tubes, which then function as capacitors having a fuel or air dielectric. The silver coating on the inner tube surface is profiled so that the probe capacitance varies as a volume curve with varying fuel levels. To improve accuracy, a fixed capacitor is located in a special cup at the lower end of certain probes so that it is always immersed in fuel. This is the capacitance index compensator (CIC), the function of which is to compensate for non-linearity of the dielectric constant.

The wing tank probes have insulated end fittings which



Fuel Quantity Indication -
Block Diagram
Figure 001



- Location of Fuel Tanks and Probes
Figure 002

R

locate in the upper and lower wing structure; the upper fitting is flexible to compensate for any tank flexing. The probe terminals are fitted externally at the top of the probe, and are polarized to prevent incorrect connection.

Tanks 6, 8, 9 and 10 probe fittings are similar to those in the wing tanks, except that the terminals are located at the bottom end of the probe.

Tanks 5A and 7A probes are necessarily short in length, and are located at the upper end only by external mounting flanges, sealed by O-ring seals.

In No.11 tank the probes are provided with additional support rings to minimize the effect of vibration caused by the extra probe length. Mounting provision for these probes is similar to that of the wing tank probes.

Dummy probes are installed in tanks 1, 4, 5, 5A, 6, 7, 7A, and 11 to accommodate level sensors (Ref. 28-42-00), with an additional dummy probe in each of tanks 5A and 7A to support CICs.

3. Quantity Packs (Ref. Fig. 003)

The channel A (LH) quantity pack is mounted on shelf 10-216; the channel B (RH) pack is mounted on shelf 9-216, in the flight compartment RH equipment racking at the 3CM station.

Apart from the normal electrical connectors, the front faces of the packs accommodate test connectors for in-situ testing, and potentiometers, which provide 'full' and 'empty' adjusting facilities for the amplifiers.

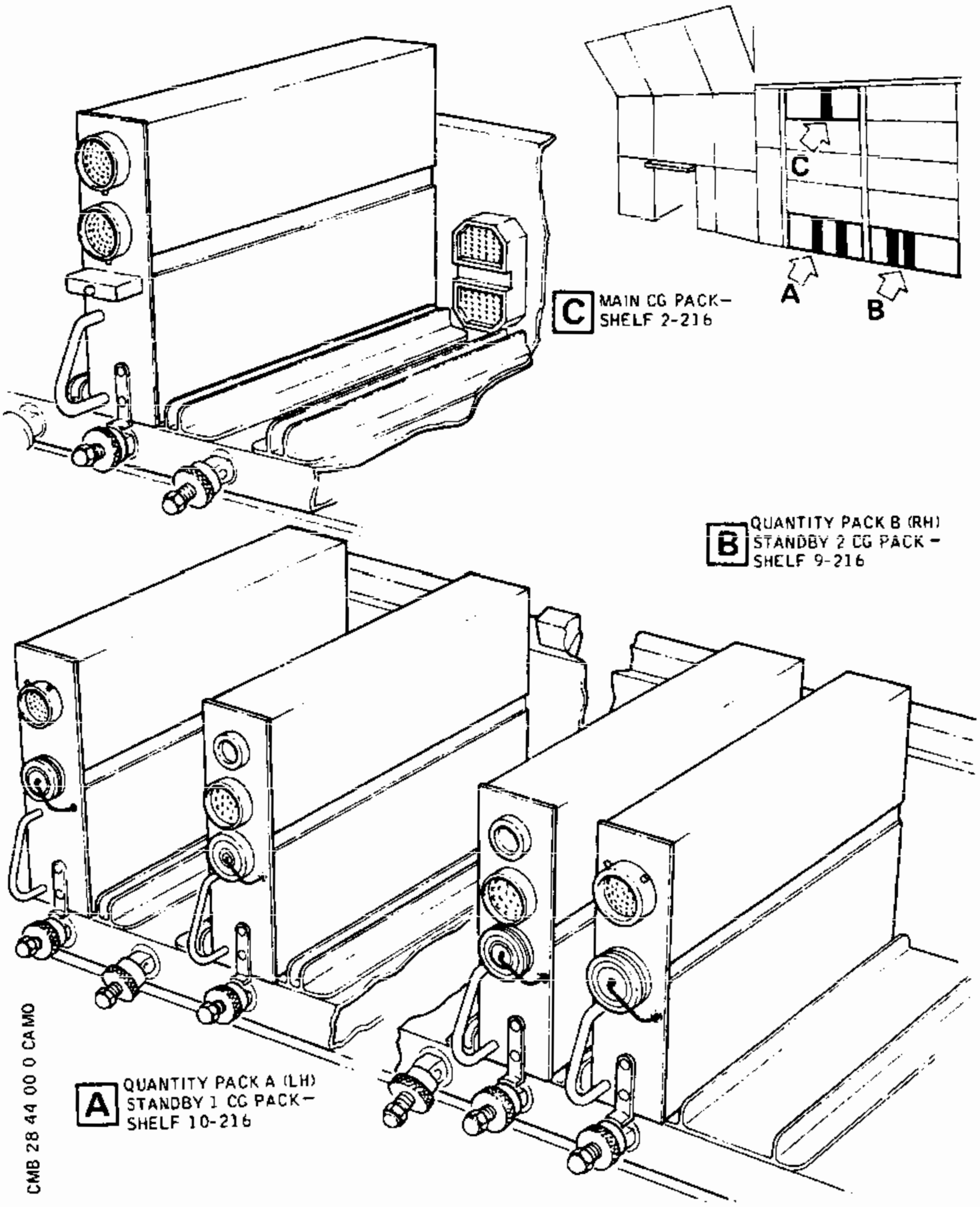
The channel A (LH) quantity pack contains:-

(1) Five gauging amplifier networks for tanks 1, 2, 5, 5A and 6, with outputs to the respective fuel contents indicators and the standby 1 c.g. pack (quantity signals).

(2) Three gauging amplifier networks for tanks 9, 10 and 11 (channel A), with outputs to the flight compartment indicators, and the standby 1 c.g. pack (quantity signals).

(3) Three fault detectors for the amplifier networks detailed in paragraph (2).

(4) Change-over relays to switch indicating signals from



\- Location of Rack-mounted Equipment
Figure 003

the system management panel contents indicators to the refuel panel contents indicators for refuelling purposes (tanks 1, 2, 5, 5A and 6 only).

(5) Two comparators to match quantity pack A to quantity pack B, with outputs to the tanks 9 and 10 failure warning lights on the FQI control panel, as well as a reset input from the FQI panel.

The channel B (RH) quantity pack contains:

(1) Five gauging amplifier networks for tanks 3, 4, 7, 7A and 8, with outputs to the respective fuel contents indicators and the standby 2 c.g. pack (quantity signals).

(2) Three gauging amplifier networks for tanks 9, 10 and 11 (channel B), with outputs to the flight compartment indicators and the standby 2 c.g. pack (quantity signals).

(3) Three fault detectors for the amplifier networks detailed in paragraph (2).

(4) Change-over relays to switch indicating signals from the system management panel contents indicators to the refuel panel indicators for refuelling purposes (tanks 3, 4, 7, 7A and 8).

(5) Two comparators to match quantity pack A to quantity pack B, with an output to the tank 11 failure warning lamp on the FQI control panel, as well as a reset from the FQI panel.

4. CG Packs (Ref. Fig. 003)

The three c.g. packs, main, standby 1 and standby 2, are located on shelves 2-216, 10-216 and 9-216 respectively, in the flight compartment RH equipment racking, at the 3CM station.

The main c.g. pack computes c.g. position in accordance with the following:-

$$CG = \frac{(ZFW \times ZFCG) \text{ and sum of 13 tank fuel wt. moments}}{ZFW + \text{total fuel wt.}}, \text{ with:-}$$

(a) Zero fuel weight fed in by the ZFW selector on the FQI panel.

(b) Zero fuel c.g. fed in by the ZFCG selector on the

FQI panel.

(c) The weight of fuel in each tank in the form of a repeater signal from each tank fuel contents indicator.

(d) Fuel tank moment arms (distance tank fuel c.g. is from fixed datum, that is 62 per cent Co) stored in the pack as fixed resistors.

(e) Total fuel weight obtained by summing the repeater signals from the refuel contents indicators.

The standby 1 c.g. pack computes the c.g. position in a similar manner to the main c.g. pack. The basic difference is that the standby 1 pack receives fuel contents repeater signals only for the tanks on the left side of the aircraft, namely tanks 1, 2, 5, 5A and 6, as well as channel A signals for tanks 9, 10 and 11. For c.g. computation the sum of the left side tank fuel moments is doubled, thereby assuming that the fuel weight and moment arm for each right side tank is identical with that of the left side.

The standby 2 c.g. pack performs in a similar manner to the standby 1 pack, except that it receives repeater data from the right side tanks only, with the information being doubled for the purpose of the c.g. equation, as with the standby 1 c.g. pack. The outputs are taken from the main c.g. pack to the total fuel contents indicators on the pilots' instrument panel, the 3CM fuel management panel and the ground refuel panel. A further output is taken to the FQI control panel, thence to the pilot's and 3CM c.g. indicators.

Outputs are taken from the standby 1 c.g. pack to the pilot's c.g. indicator, and from the standby 2 pack to the FQI control panel, the co-pilot's machmeter, and the 3CM c.g. indicator.

R Both standby c.g. packs are connected electrically to the
R T/O CG selector toggle switch on panel 1-214.

An electrical output is taken from the standby 1 c.g. pack to a red M/CG warning caption on the pilot's instrument panel; a second output is taken from the standby 2 c.g. pack to a red M/CG warning caption on the co-pilot's instrument panel. Connections are taken from both packs to the master warning system.

5. Contents Indicators (Ref. Fig. 004, 005 and 006)

Each contents indicator, with the exception of the tanks 9, 10 and 11 flight contents indicators, incorporates a single

miniature two-phase servomotor which drives, through reduction gearing, a pointer, a digital counter and several potentiometers. One potentiometer in each indicator supplies a rebalance signal to the associated gauging amplifier network; the remaining potentiometers provide repeater signals for various control purposes. The internal mechanisms for tanks 9, 10 and 11 contents indicators differ from the other contents indicators, in that the pointer for each indicator is driven by two servomotor mechanisms through a differential gearing, which transmits the two drives simultaneously, or either one singly. A third servometer drives the digital counter, across which a warning flag appears if there is a counter failure, although the pointer may still operate correctly.
A failure warning flag is displayed in the counter aperture to obscure the digital readout if -

(1) the power supply is interrupted, or

(2) the control phase of the servomotor fails to nullify within 5 s.

The indicator casings are filled with an inert gas and hermetically sealed. The dial presentation is integrally illuminated.

The flight and refuel contents indicators are duplicated for each tank, with the pairs of indicators giving the same reading. The indicators are calibrated in kg x 1,000, with the readings being:-

For tanks 1, 2, 3, 4, 5A and 7A: 0 to 5,000.

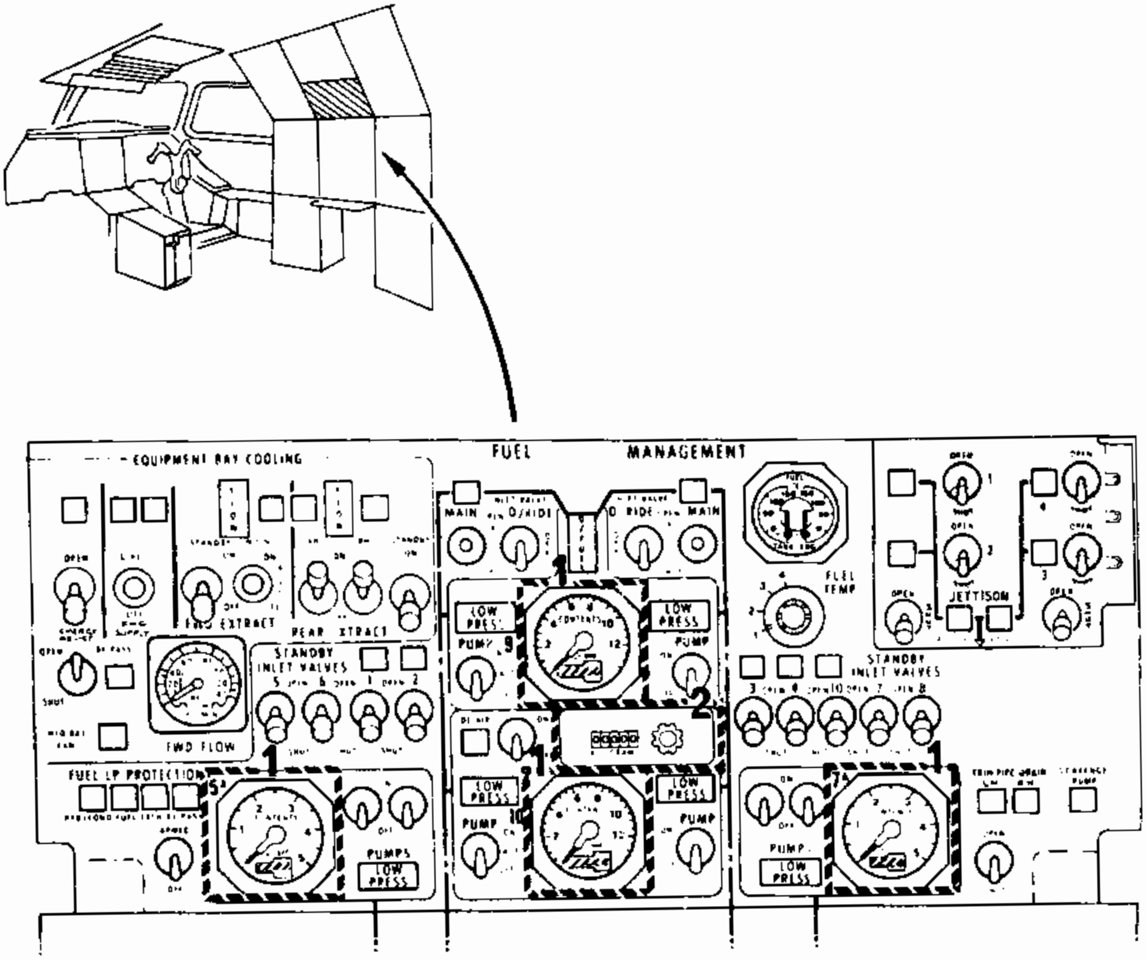
For tanks 5 and 7: 0 to 10,000.

For tanks 6, 8, 9, 10 and 11: 0 to 13,500.

The total fuel contents indicators at all three positions, that is, pilots' centre instrument panel, fuel management panel and refuel panel, read from 0 to 90,000 kg. Power failure on these digital indicators is signalled by a red and black diagonally striped failure warning flag.

6. Load Limit Selectors

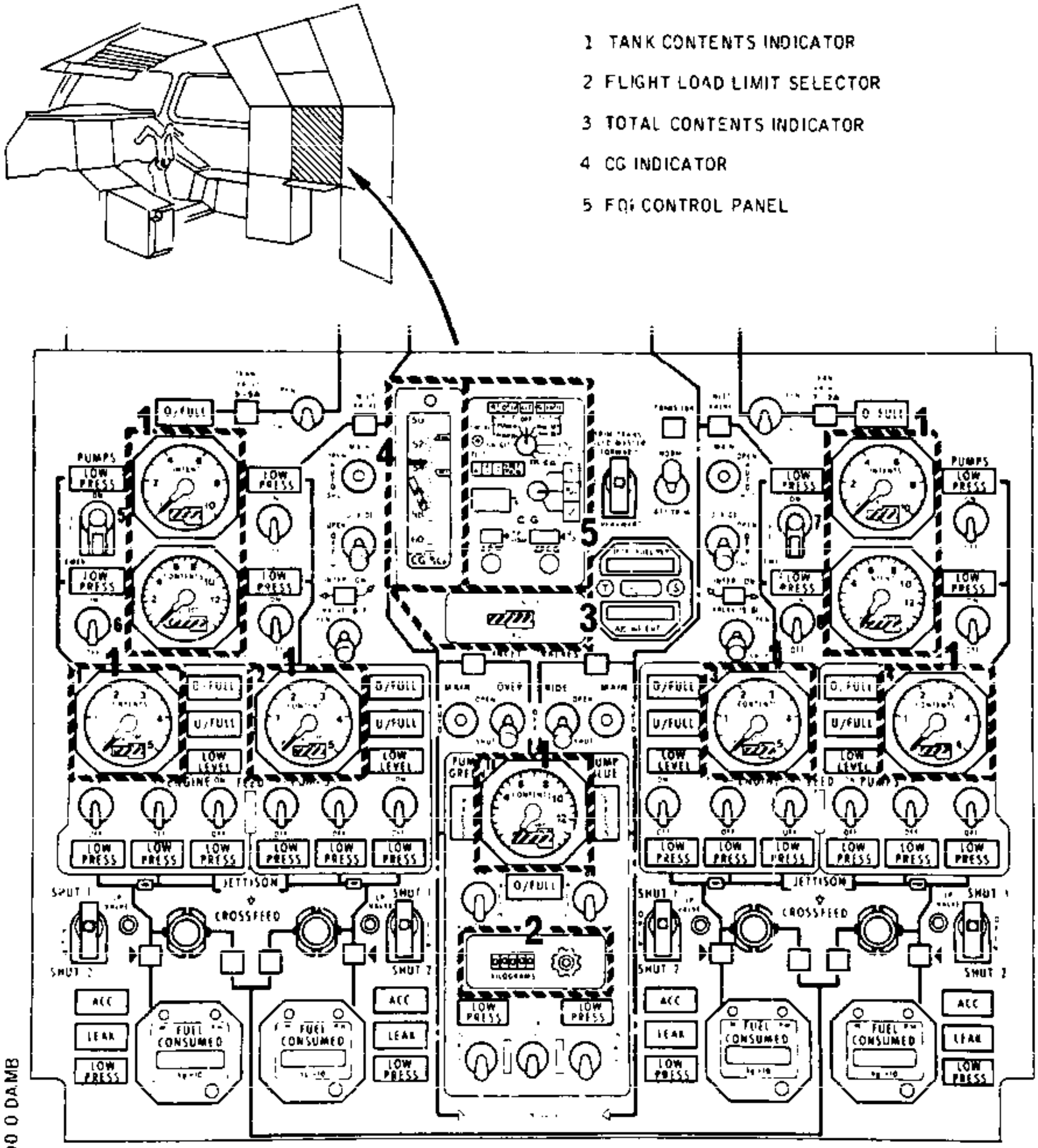
The six load limit selectors, two located on the fuel management panel and four on the refuel panel, are all similar, with digital counters, and potentiometers operated through reduction gearing by manual setting knobs. The required loads are set on the counters and the setting is transmitted simultaneously from the



PANEL 2-214

CMB 28 44 00 0 DAMA

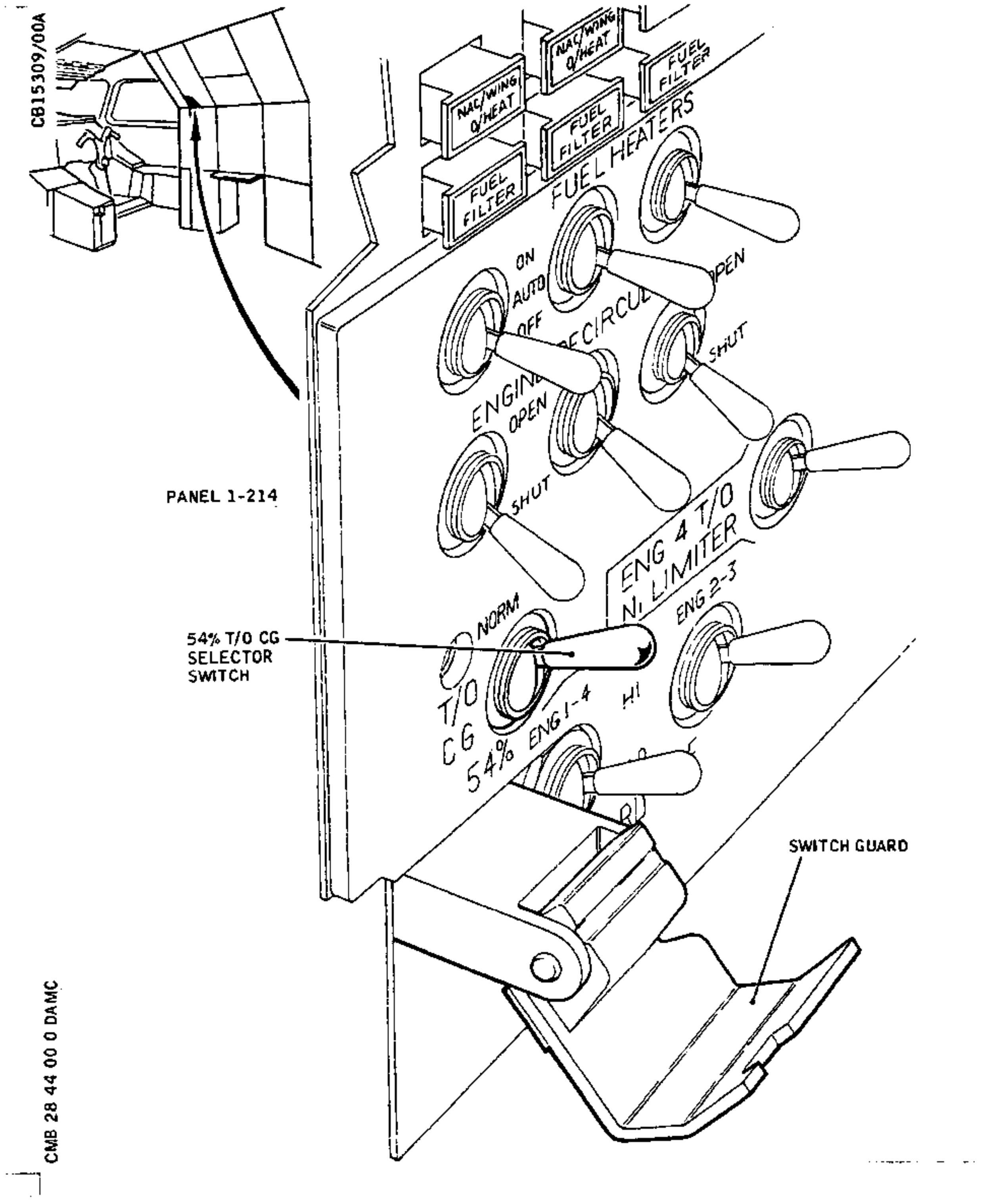
Fuel Management Panel - Controls
and Indicators (Sheet 1 of 3)
Figure 004



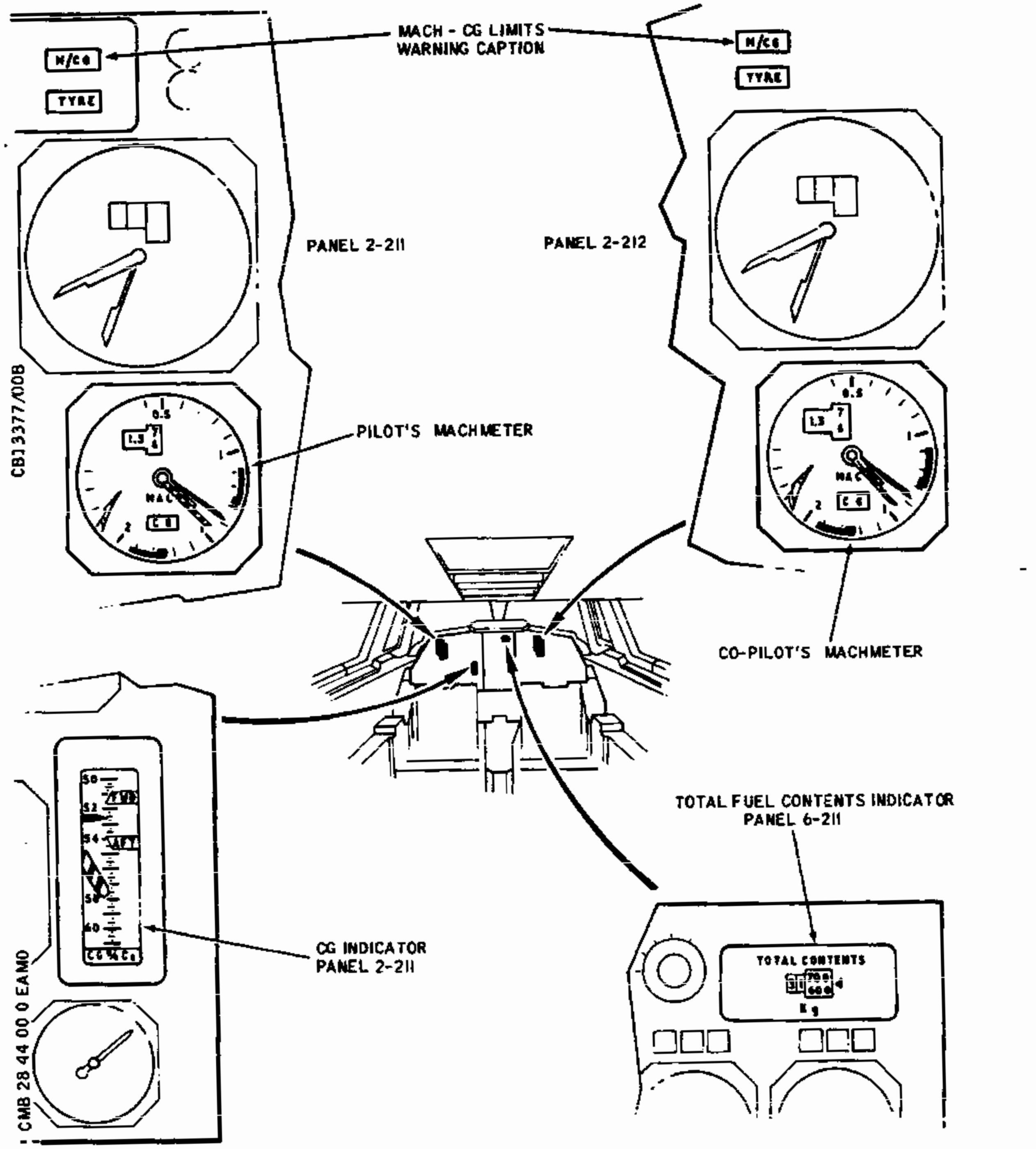
PANEL 5-214

CMB 28 44 00 0 DAMB

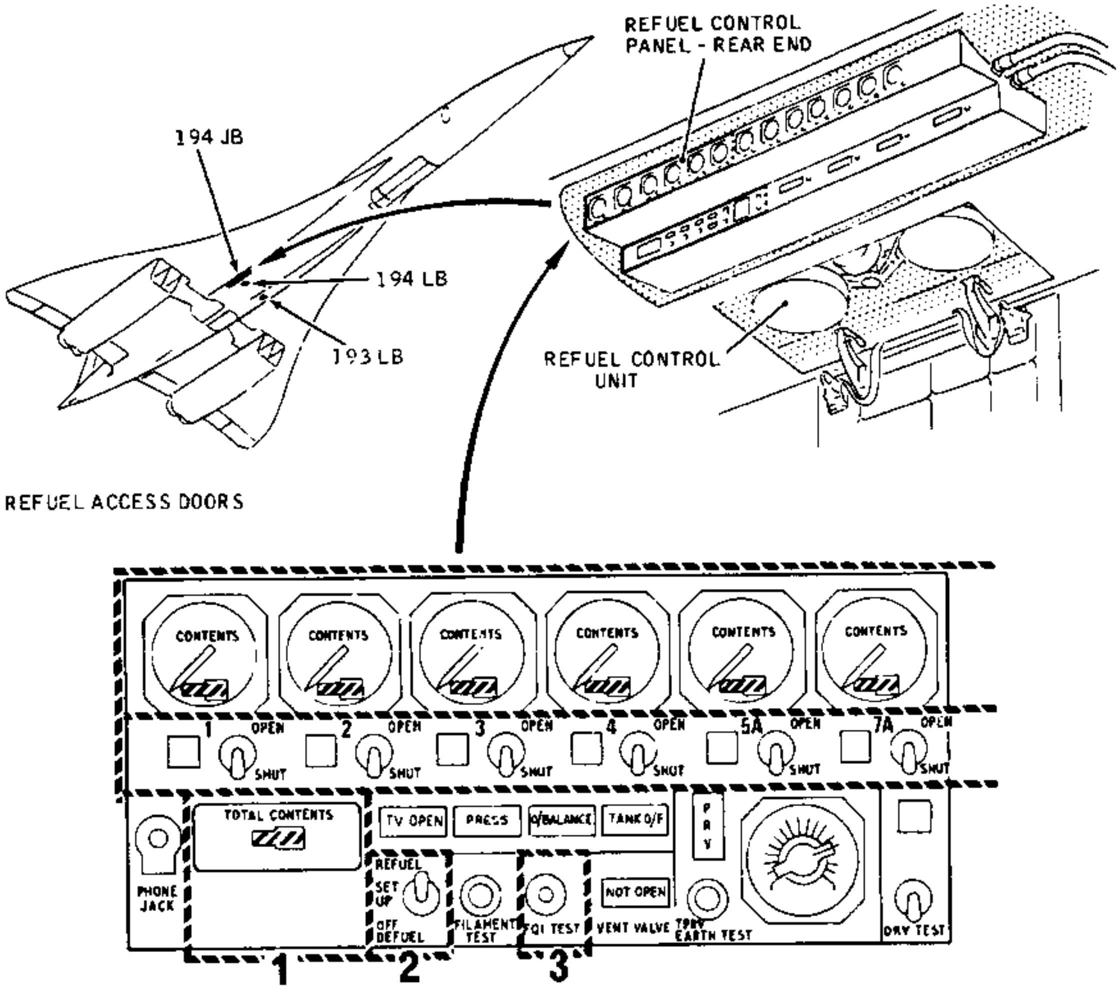
Fuel Management Panel - Controls and Indicators (Sheet 2 of 3)
Figure 004



R - 54 Per Cent T/O CG Selector Switch (Sheet 3 of 3)
Figure 004



Pilots' Instrument Panel -
Total Fuel and CG Indicators
Figure 005



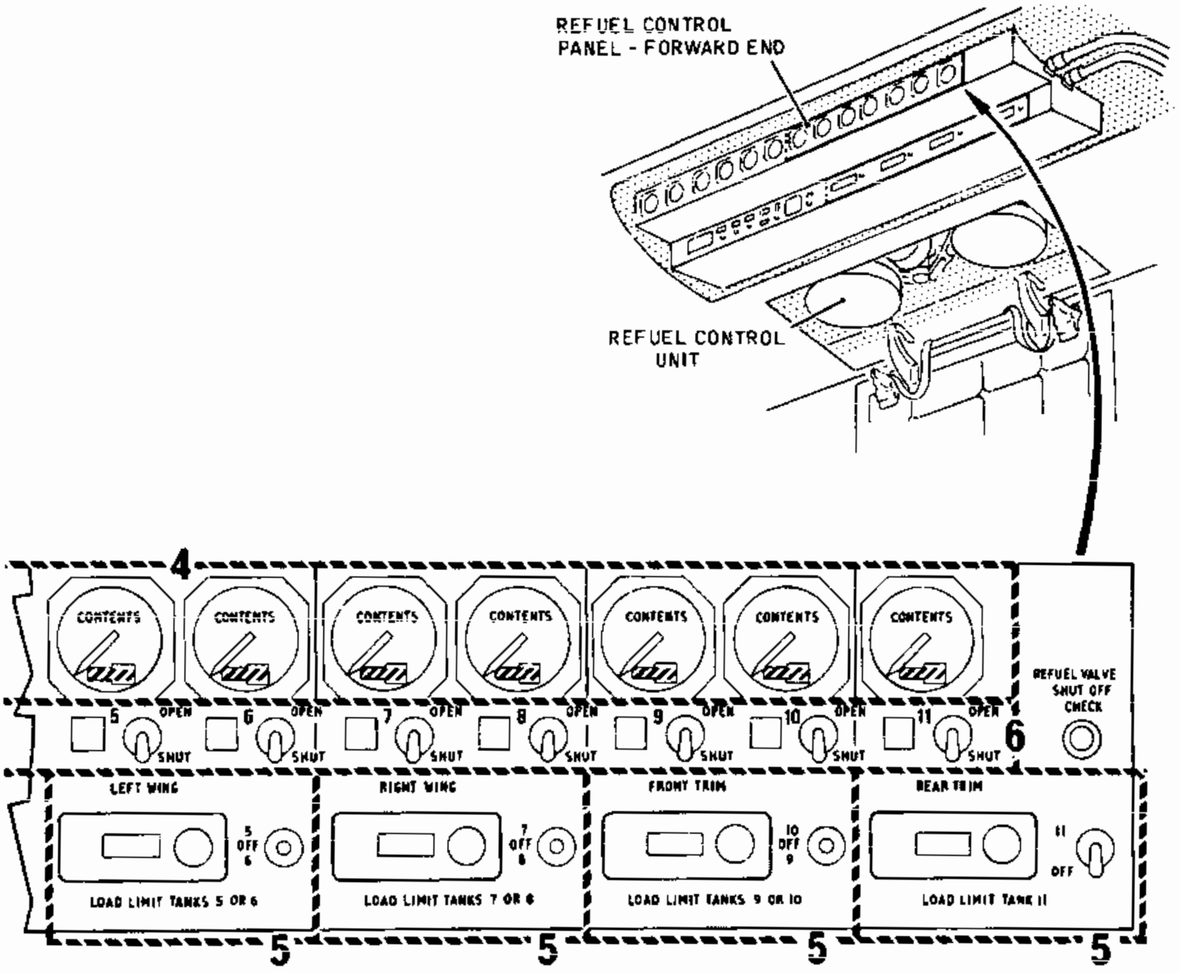
1 TOTAL CONTENTS INDICATOR

2 REFUEL MASTER SWITCH

3 FQI TEST SWITCH

CMB 28 44 00 0 FAMA

\- Refuelling Control Panel (Sheet 1 of 2)
Figure 006



4 TANK CONTENTS INDICATORS

5 REFUEL LOAD LIMIT SELECTOR AND TANK SELECTOR SWITCH

6 REFUEL VALVE CONTROL SWITCHES

28 44 00 0 FAMB

– Refuelling Control Panel (Sheet 2 of 2)
Figure 006

potentiometer to the associated load limit control amplifiers in the respective c.g. packs.

The flight load limit selectors for tanks 9 plus 10, and 11, have ranges from 0 to 25,000 and 0 to 14,500 kg. Each selector incorporates two potentiometers with outputs connected to the associated load limit control amplifiers for channels A and B in the respective c.g. packs.

The refuel load limit selectors for tanks 5 or 6, 7 or 8, 9 or 10, and 11 each have a range from 0 to 14,500 kg, and include a single potentiometer. The potentiometer output signals are connected as required to the appropriate load limit control amplifiers through the adjacent tank selectors in each case, with the exception of tank 11.

One selector switch is provided for each pair of tanks, apart from tank 11 which has its own individual switch; the switches are of two-pole, three-position, with centre-off, type. A particular tank selection is made when the switch toggle is moved toward the appropriate tank number engraving on the refuel panel.

7. CG Indicators (Ref. Fig.004 and 005)

The integrally illuminated indicator consists of a vertical pointer type meter graduated from 50 to 61 with intermediate increments. The main pointer is normally positioned within boundaries formed by two orange limit bugs FWD and AFT. An inset red limits warning lamp is provided at the top of the instrument bezel.

The bugs, which move over the fixed scale to indicate the band within which the white c.g. pointer must be maintained, are driven separately by a d.c. stepper motor, within the indicator, that functions in a similar manner to the servo mechanism arrangement used in the contents indicators. The control signal for each bug servo amplifier is derived from a comparator that senses signals representing:-

(1) Mach number from the air data computer (ADC 1 for the pilot's c.g. indicator, and ADC 2 for the 3CM c.g. indicator).

(2) Total aircraft weight from either the main, standby 1 or standby 2 c.g. channel, depending on the position of the c.g. channel selector switch on the FQI control panel.

The limits display is provided by two identical but separate channels. One is contained in the standby 1 c.g. pack and

serves the pilot's c.g. indicator and machmeter. The second channel is contained in the standby 2 c.g. pack and serves the co-pilot's machmeter and the 3CM c.g. indicator.

A diagonally striped failure warning flag appears on the indicator meter dial if there is servo unbalance, loss of power supply, jammed bugs, or loss of validity signal to the indicator pointer.

8. <u>FQI Control Panel</u> (Ref. Fig. 004)

The FQI panel houses the switches and indicators for testing the fuel quantity indication system, and provides a means of testing the system before flight, and assisting fault diagnosis if there is any in-flight failure of all or part of the system. Additionally two selector knobs and counters are provided for the purpose of feeding in fuel information for c.g. computation.

The FQI panel accommodates:-

(1) A strip of seven yellow caption lights, of which the duplicated captions annotated 9, 10 and 11 will be illuminated if there is a channel A or B gauging failure, and the LLC caption will be illuminated if there is a load limit control failure.

R (2) A multi-position rotary (MPR) switch for system testing.

(3) A TEST/CANCEL three-position centre-off switch.

(4) A strip of five yellow caption lights for tanks 1 and 4, 2 and 3, 5 and 7, 5A and 7A, and 6 and 8. The paired tanks are those with identical fuel contents, and the warning captions will be illuminated if the fuel contents comparison between any two tanks is outside the predetermined limits, with the faulty channel being determined by reference to the two appropriate contents indicators.

(5) A 'seven bar display' type indicator that shows c.g. position per cent Co.

R (6) A CG channel selector switch and three captions,
1, M and 2, for the standby 1, main, and standby 2 c.g.
R channels. If there is a channel failure the associated
R caption is illuminated amber.

(7) A ZFW selector that presets zero fuel weight on an adjacent counter-type indicator.

(8) A ZFCG selector that presets zero fuel centre of gravity on an adjacent counter-type indicator.

9. Operation (Ref. Fig.007 and 008)

A. Control and Indication

The fuel contents indicators are grouped together in two locations:-

(1) The upper and lower fuel management panels 2-214 and 5-214, together with the tanks 9, 10 and 11 flight load limit selectors, the 3CM c.g indicator, the 3CM total fuel contents indicator and the FQI control panel.

(2) The refuel panel 1-194, together with the load limits selectors, and total fuel contents indicators.

A duplicate total fuel contents indicator is installed at the top of the pilots' centre instrument panel 6-211. The c.g. indicator is duplicated on the pilot's instrument panel 2-211. C.g. information is signalled to both pilots' machmeters, and if the mach-c.g. limits are exceeded, warning is given on the red warning lamps on the c.g. indicators, and red M/CG captions on panels 2-211 and 2-212; the captions are provided with dimming and test facilities (Ref. 33-14-00).

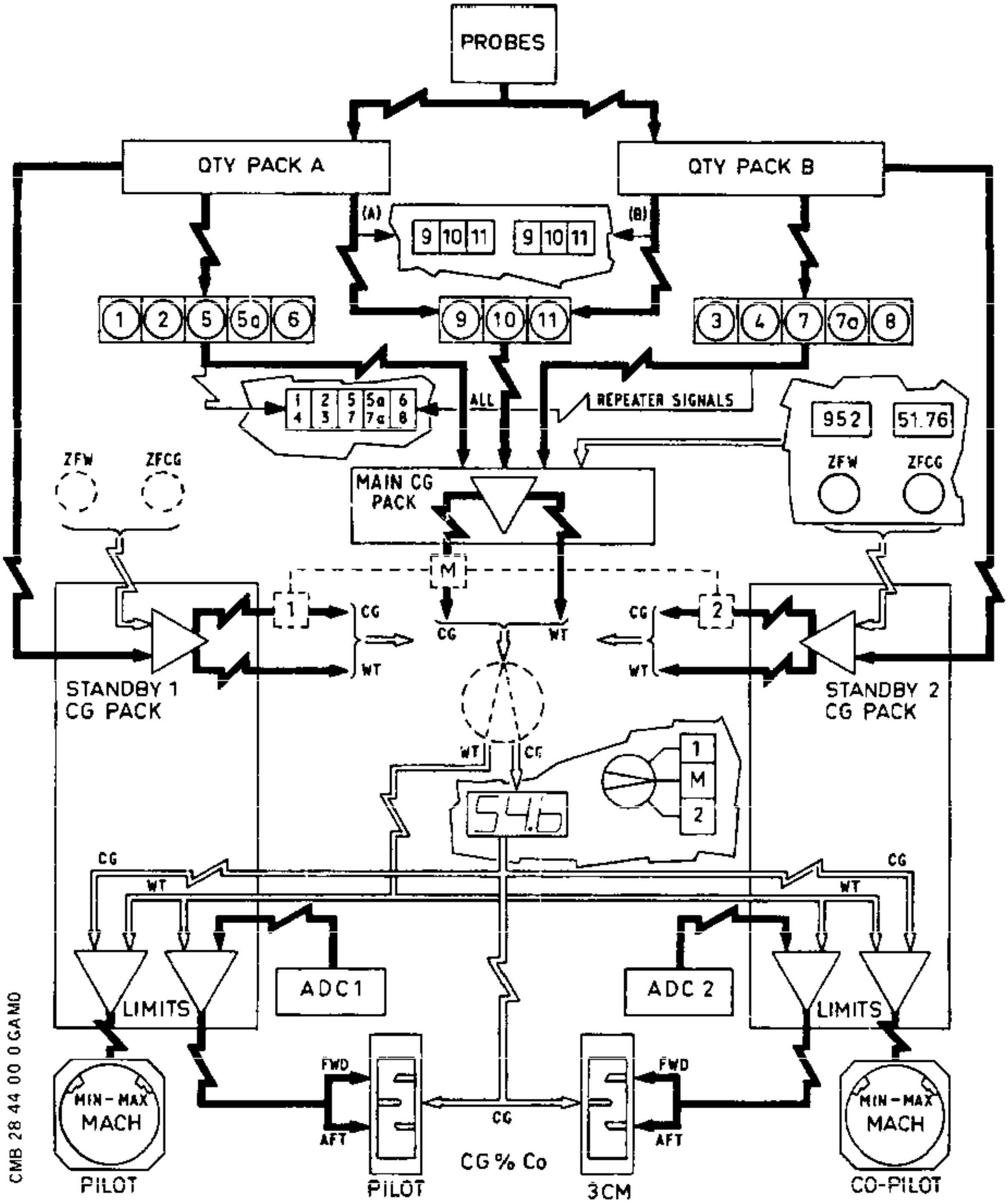
The FQI system control is managed by the three c.g. packs, main, standby 1 and standby 2. Partial control for load limit control purposes is managed by the level switching packs (Ref. 28-42-00).

B. Functional Description

Fuel quantity for all tanks is indicated on the flight contents indicators on the fuel management panels, or the refuel panel contents indicators, depending on the position of the refuel master switch, which controls the position of the flight/refuel change-over relays in the quantity packs. The contents of tanks 9, 10 and 11 are indicated simultaneously on both panels.

Tanks 1 to 8 have their fuel contents measured and indicated by single gauging channels, whereas trim tanks 9, 10, and 11 have dual channels for reliability.

In a single gauging channel fuel contents indication is provided by a servo loop in which the amplifier network



CG Indication and Mach-CG Limits
System - Block Diagram
Figure 007

compares a variable signal from the probes (depending on the level of the fuel in the tank), with a rebalance signal from the contents indicator. When the two inputs are unbalanced, for example, during flight when fuel is being consumed, or during refuelling when the tanks are being replenished, the resultant output signal is amplified and fed to the control phase of the contents indicator servomotor which drives the indicator display, and a rebalance potentiometer to null the output signal. The servomotor drives the indicator pointer and a digital display through reduction gearing, as well as other potentiometers which provide repeater signals for total fuel/c.g. computation.

Dual gauging channels (A and B) are utilized for tanks 9, 10, and 11. Each channel functions similarly to the single gauging channel and provides a signal to control its own two-phase servomotor within the contents indicator. Both servomotors drive the indicator pointer simultaneously, through reduction gearing. By this arrangement a single servomotor will continue to drive the indicator pointer, if one channel fails. With both channels operating, the pointer display is the mean of the two channels, thus giving the average error of the individual channel.

A failure detector is provided for each pair of tank gauging channels, to disconnect a faulty channel, automatically, and render it inoperative electrically, if there is a large unbalance signal, or the disappearance of signal from a channel. If a channel is disconnected by the failure detector, the associated yellow warning caption is illuminated on the FQI panel.

For refuelling purposes the required fuel load is set on the load limit selectors on the ground refuel panel, and refuelling ceases automatically when the preset figures are attained (Ref. 12-11-28), with the individual tank contents being shown on the contents indicators. When refuelling is completed, with the master switch set to the OFF position, the refuel panel contents indicators are isolated, and contents indication and control is transferred to the 3CM fuel management panel. During flight, as fuel is consumed, balanced readings are shewn on the indicators for the left and right sides of the aircraft, with trim tank indication varying with the aircraft attitude and flight configuration. Simultaneously the pilots' and 3CM total fuel contents indicators will indicate the reducing total fuel in the aircraft tanks, the information being

signalled from the main c.g. pack.

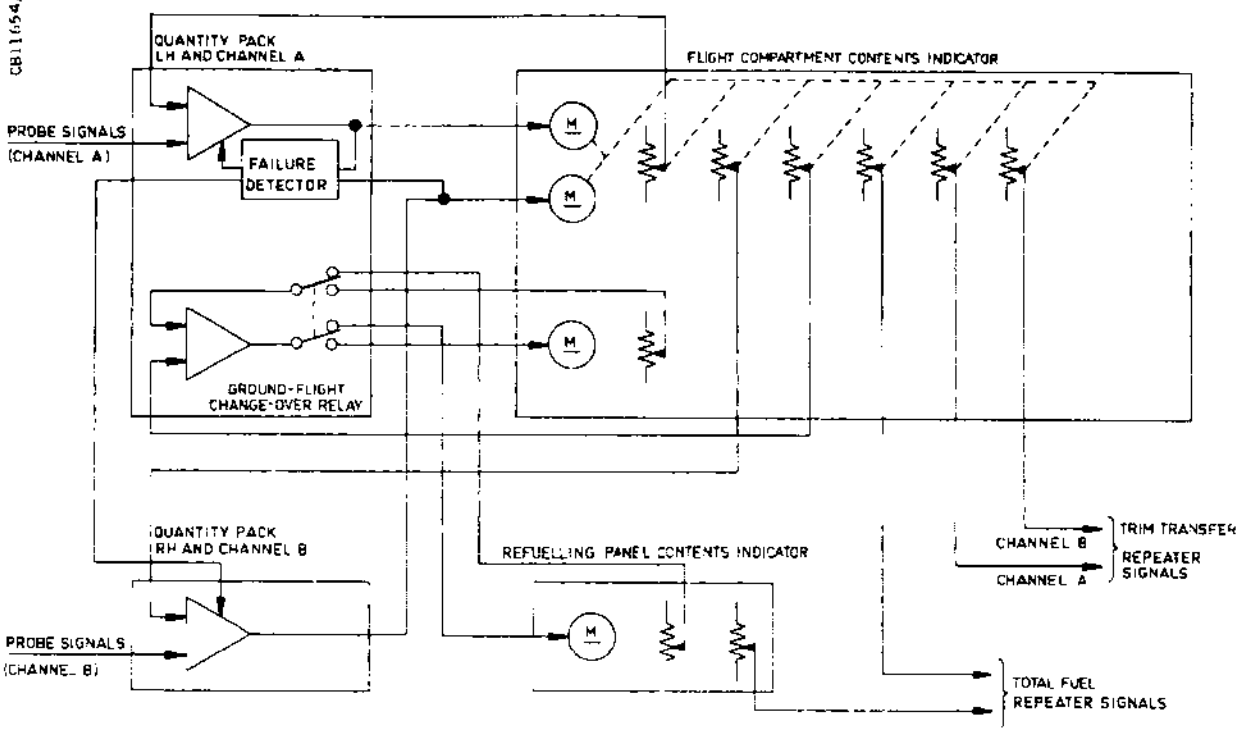
C. CG Position Control

As fuel is consumed by the engines, during flight, aircraft c.g. movement is restricted to a minimum by the sequence of fuel consumption from the main transfer tanks 5, 6, 7 and 8, which are used to replenish the engine (feed) collector tanks 1, 2, 3 and 4. Tanks 1 and 2 are supplied simultaneously by tank 5, followed by tank 6, with tanks 3 and 4 being supplied in a similar sequence by tanks 7 and 8. By transferring fuel at the same rate from left and right side tanks with opposite pitching moments, aircraft balance is maintained, and c.g. movement of fuel in the main tanks is reduced to a minimum. Fuel from tanks 5a and 7a is transferred into tanks 5 and 7 for eventual transfer into the associated collector tanks.

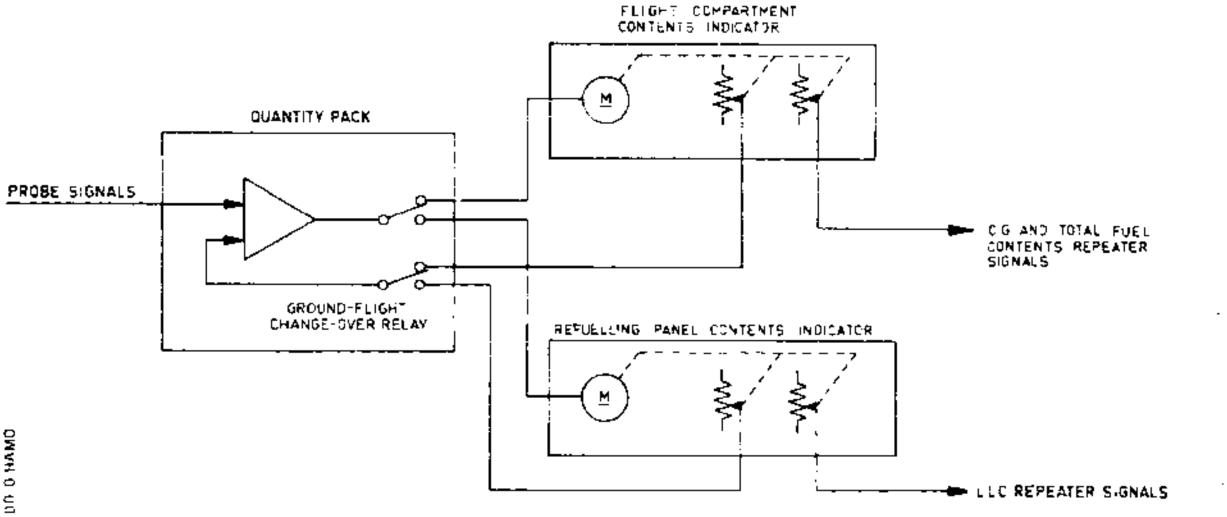
When a specific c.g. movement is required, as, for example, when the aircraft passes from subsonic to supersonic flight, the necessary adjustment is effected by using the trim transfer system to vary fuel disposition between tanks 9, 10 and 11. Fuel is transferred from tanks 9 and 10 into tanks 11, 5 and 7 to move the aircraft c.g. rearward, or from tank 11 into tanks 9, 5 and 7 for a forward c.g. movement. Each trim transfer operation is preselected manually on the two load limit selectors, one for tanks 9 and 10, the other for tank 11 on the fuel management panel, for any tank value between empty and high level, and once initiated is controlled automatically.

The preselected input is compared with an input, representing fuel contents, from a gauging channel; when the two inputs are unbalanced (that is, when the preselected value is more or less than the tank contents value) the resultant signal is used to control the operation of the associated trim tank pumps and inlet valves in conjunction with the trim transfer REARWARD/FORWARD master switch (Ref. 28-23-00).

Fuel is transferred in or out of the respective trim tank, until the unbalanced signal is balanced, when the preselected value equals tank contents. Any fuel in excess of trim tank requirements is transferred automatically into tanks 5 and 7 (Ref. 28-23-00). As the load limit control channels for each trim tank are duplicated, one channel will continue to control



A TRIM TANK GAUGING CHANNEL



B BASIC GAUGING CHANNEL

Typical Basic and Trim Tank
Gauging Channels
Figure 008

operations, if there is a channel failure. Protection against fuel overfilling is provided by the fuel level system (Ref. 28-42-00).

During flight the aircraft c.g. position is displayed to the pilot and the 3CM on identical c.g. indicators, with c.g. information repeated on the pilot's machmeters. In addition c.g. information is provided at the 3CM station on the FQI control panel.

C.g. display is derived from any one of three channels, 1, M or 2, depending on the position of the selector switch (normally at M), with the selected c.g. pack providing the necessary c.g. information; all three channels 1, M or 2, have a white background, irrespective of which channel is selected. If a selected channel fails, the white light changes to amber, to give an amber warning. This warning is accompanied by an amber master warning. With the ZFW and ZFCG selections made, the selected c.g. pack computes the aircraft c.g. as described in paragraph 4., the resultant c.g. information being shown on the digital % c.g. counter. This reading is repeated on the pointer scale of the pilot's and 3CM c.g. indicators.

Two orange bugs, engraved FWD and AFT, denote the band within which the c.g. pointer position is to be maintained. Two bugs on the pilots' machmeters similarly denote the mach limits, relative to c.g. position, within which the mach pointer should be held.

For take-off the normal c.g. position is 53.5 per cent Co nominal, and if this figure is exceeded an aft boundary warning system is activated. To enable more fuel to be uplifted in the No.11 tank, a rearward c.g. movement is required. When the magnetically latched T/O CG toggle switch on panel 1-214 is moved from NORM to the 54% position, this action has the effect of moving the permitted take-off c.g. position to 54 per cent Co nominal, thus retarding the boundary warning operation to compensate for the additional fuel loading. To cancel the override action the switch can be manually set to NORM, or the magnetic latching will be de-energized through the operation of the Nos.9 or 10 tanks trim pump control switches, when the c.g. control will revert to normal operation.

After SB 28-048 For A/C 001-007,

R The starting cycle of a fuel trim pump is controlled by a pulse start unit, which controls the average starting acceleration of the pump uniformly. Five per cent power is applied to the pump on the first pulse, rising to 100 per cent on the last pulse, over a 5 s period. The sequence is initiated whenever the pump control switch is set to ON or AUTO (Ref. 28-23-00).

As aircraft speed increases, the c.g. position is adjusted by transferring fuel as necessary, with the new c.g. position shown on the c.g. indicators. This position will vary from approximately 53.5 per cent Co at take-off to approximately 59 per cent for supersonic cruise, returning to 53 per cent for landing. If the mach-c.g. number values are exceeded, warnings are provided at two levels. The first warning is activated at the normal boundary limits level, and the second, or extreme boundary warning, is activated if the normal limits are exceeded by a predetermined amount. This second warning indicates that normal boundary warning corrective action is not being activated sufficiently rapidly, or is being ignored.

For reliability the standby 1 c.g. pack activates the pilot's machmeter and c.g. indicator warnings; the standby 2 c.g. pack activates identical warnings on the co-pilot's machmeter and 3CM c.g. indicator.

If the normal boundary FWD or AFT limits are exceeded the boundary warnings are displaced and the following actions take place :-

(1) The c.g. indicator red warning lamp is illuminated steadily.

(2) The red M/CG captions on the pilots' instrument panels are illuminated steadily.

(3) A red M/CG master warning is given, accompanied by a single-stroke gong.

If extreme FWD boundary warning limits are exceeded:-

(1) The c.g. indicator lamp flashes on and off.

(2) The red M/CG captions on the pilots' instrument panels flash on and off.

(3) The master warning remains activated, accompanied by a single-stroke gong.

If extreme AFT boundary warning limits are exceeded, the warnings are repeated as for extreme FWD limits, with the additional activation of the stick-shaker under certain flight conditions, namely, for speeds M greater than 0.45 and M less than 1.6. The stick-shaker is inoperative for speeds M less than 0.45 and M greater than 1.6.

If there is a failure of c.g. information, servo unbalance, loss of validity signal or loss of power supply, a flag engraved CG appears in a window in the dial of the affected machmeter.

Apart from its normal function, the FQI control panel provides facilities for testing the FQI system.

10. Electrical Power Supplies

Electrical power supplies for the fuel quantity indication system are taken from the Nos.1, 2 and 4 essential 115 V a.c. busbars, the No.2 main 115 V a.c. busbar, the 'B' avionics 115 V a.c. busbar, and the 'A' and 'B' 28 V d.c. busbars. FQI control panel test supplies are taken from the 'A' main 28 V d.c. busbar.

FUEL QUANTITY INDICATION SYSTEM - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Preparation

A. Ensure that the associated circuit breakers are set (Ref. Table 101, items (1), (2), (3), (4), (5) and (6)).

B. Make available electrical ground power as detailed in 24-41-00.

C. If any FQI control panel rotary selector switch malfunctions are suspected, renew the FQI panel (26).

R

B CAUTION: BY REPETITIVE SWITCHING OF THE 'TEST/CANCEL' SWITCH, CHANGING PACKS WITH THE POWER STILL ON ETC., THE SEQUENCE OF MAKE AND BREAKS EXPERIENCED BY THE FAULT COMPARATOR CIRCUITS CAN CAUSE THE LOGIC TO FALSELY INDICATE TWO FAILED CHANNELS.
TO ENABLE THE FAULT LOGIC TO FUNCTION CORRECTLY, IT IS ESSENTIAL THAT THE FOLLOWING PRESCRIBED ACTIONS ARE ADHERED TO.

B A. THE FQI 'TEST/CANCEL' SWITCH SHOULD BE OPERATED TO 'CANCEL' IN A SINGLE POSITIVE ACTION WHICH SHOULD NOT BE REPEATED AT LESS THAN TEN SECOND INTERVALS.

B B. THE CONNECTORS ON THE FRONT OF THE QUANTITY PACKS, OR THE PACKS THEMSELVES, SHOULD NEVER BE DISCONNECTED AND RECONNECTED WITH THE POWER APPLIED TO THEM.

B C. IT IS IMPERATIVE TO AVOID REPEATED OPERATION OF THE CHANNEL A & B SUPPLY CIRCUIT BREAKERS IN AN ATTEMPT TO REGAIN A CHANNEL. WHEN IT IS NECESSARY TO TRIP OR REGAIN THE SUPPLY, BOTH CIRCUIT BREAKERS MUST BE OPERATED SIMULTANEOUSLY I.E. WITHIN 1 SECOND.

3. Trouble Shooting

B NOTE: Inaccurate fuel quantity readings can often be caused by bad connections at a tank probe. Therefore, as opposed to replacing the probe it is advisable to first attempt to clear the defect by remaking the connections at the probe.

B Replace all tag ends at the probe and replace the on-line splice using the Concorde avionic fuel tank kit P/N PM82228. Make reference to the standard practices on crimping in WDM 20-42-08.

B If the defect remains after remaking connections the appropriate probe should be replaced.

B If the defect still remains it is likely that the appropriate tank harness will need replacing.

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A. *
* Prepare to trouble shoot (Ref. para.2.).*
* Check that with power supplies connected*
* FQI and CG indicator failure flags are *
* withdrawn and the FQI indicator pointers *
* and digital repeaters show tank contents*
*
* NOTE: Comparison of FQI indicator *
* readings can be made between fuel*
* management panels and ground *
* refuel panel 1-194. *
* *

OK

NOT-OK:

1. Failure flags not withdrawn when power supplies connected - Chart 101.
2. Indicator reading incorrectly or not at all, but failure flags withdrawn - Chart 102.

B. *
* On the FQI control panel, with the ZFCG *
* set to 52.50 and the ZFW set to 85,870 *
* kg, check that the ZFCG is repeated on *
* each CG indicator (pilot and 3CM) and *
* the 3CM seven-bar % CG display. *
* *

OK

NOT-OK:

1. With ZFCG set to 52.50 and ZFW set to 85,870 kg on FQI control panel, CG readings on pilot's and 3CM CG indicators and 3CM seven-bar display do not agree - Chart 103.

R

C.
```
****************************************
*With the FQI panel rotary test switch  *
*set to MIN A and the TEST - CANCEL     *
*switch set to TEST, check that the     *
*Channel A failure indicator captions 9,*
*10 and 11 are illuminated after 6(±1) s.*
*Return the TEST - CANCEL switch to     *
*CANCEL and check that the captions are *
*extinguished.                          *
*                                       *
*NOTE:  This test is satisfactory for the*
*       position MIN B.  Also for MAX A *
*       and MAX B except that the time- *
*       delay is 1.5 (±0.5) s.          *
*                                       *
*NOTE:  TEST - CANCEL switch read CAUTION*  (B)
*       28-44-00 Page 102 Para. 2.      *  (B)
****************************************
```

OK

NOT OK

1. Channel A, 9, 10, 11 captions are not illuminated when FQI rotary switch set to MIN A and TEST switch set to TEST - Chart 104.
2. Channel A, 9, 10, 11 captions are not extinguished when TEST switch set to CANCEL. Renew TEST - CANCEL switch.

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R

D. **
*With the FQI control panel multi- *
*position rotary switch set to CG1, the *
CG rotary switch set to M and the TEST -
*CANCEL switch set to TEST, check that *
*the twin-tank comparator captions are *
*not illuminated but the Channel A11 *
*caption is illuminated. The 9, 10 *
*captions may illuminate, depending on *
*system tolerances. *
Check that the captions are extinguished
*when the test switch is set to CANCEL. *
* *
*NOTE: This test also applies with the *
* rotary test switch set to CG2, *
* except that the Channel B11 *
* caption is illuminated. *
* *
NOTE: TEST - CANCEL switch read CAUTION
* 28-44-00 Page 102 Para. 2. *
****

OK NOT OK

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```
       |          |
       |          |          -----------------------------------
       |          |         |1. Comparator captions are illum- |
       OK         NOT OK----|   inated for certain tanks -     |
       |                    |   Chart 105.                     |
       |                    |2. Channel A or B 11 (9 or 10)    |
       |                    |   caption is not illuminated -   |
       |                    |   check fuel quantity and gauging|
       |                    |   for tank 11 (including probes).|
       |                     -----------------------------------
       |
E.******************************************
  *NOTE:  For this test ADC 1 and/or 2 must*
  *be switched ON.                         *
  *                                        *
  *On the FQI control panel check that the *
  *ZFCG is set to 53.0 % Co.  Adjust the CG*
  *reading until at approx. 53.8 % Co the  *
  *normal AFT boundary warnings are        *
  *activated.                              *
  ******************************************
       |          |
       |          |          -----------------------------------
       |          |         |At 53.8 % Co CG the normal aft    |
       OK         NOT OK----|boundary warnings are not         |
       |                    |activated - trouble-shoot ADC 1 or|
       |                    |ADC 2 systems (Ref. Chap.27).  If |
       |                    |this does not rectify the fault,  |
       |                    |renew the Standby 1 or Standby 2  |
       |                    |CG Packs (25) or (27) as appro-   |
       |                    |priate.                           |
       |                     -----------------------------------
       |                                   |
F.******************************************   |
  *Further adjust the ZFCG to activate the *-------NOT OK
  *extreme boundary warnings (Ref.         *
  *Adjustment/Test) if NOT OK, proceed as  *
  *for normal boundary warning.            *
  ******************************************
```

```
*********************************
*INDICATOR FAILURE FLAGS NOT    *
*WITHDRAWN WHEN POWER SUPPLIES*
*CONNECTED.                     *
*********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

```
 ---------------            ----------------
|Check for 115 V|          |Renew appropriate|
|a.c. output    |-YES-     |Tanks Contents   |
|from CB(1),(2),|          |Indicator (9),   |
|(3),(4),(5),   |          |(10),(11),(12),  |
|(6),(7) or (8).|          |(13),(14),(15),  |
 ---------------           |(16),(17),(18),  |
                           |(19),(20) or     |
                           |(21).            |
                            ----------------
       |
       |
       NO
       |
       |
 ---------------
|Renew CB (1),  |
|(2),(3),(4),   |
|(5),(6),(7) or |
|(8).           |
 ---------------
```

Chart 101

FQI INDICATOR READING INCORRECTLY OR NOT AT ALL, BUT FAILURE FLAG WITHDRAWN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-

Renew Tank Contents Indicator (9),(10),(11), (12),(13),(14), (15),(16),(17), (18),(19),(20) or (21). Is fault cleared?

-NO-->

Renew Quantity Pack A (22) or Quantity Pack B (23) as appropriate. Is fault cleared?

-NO-->

Renew appropriate probe in tank 1 to 11, as necessary: Items (30),(31),(32), (33),(34),(35), (36), or (37).

Chart 102

WITH ZFCG SET TO 52.50 AND ZFW SET TO 85,870 kg ON FQI CONTROL PANEL, CG READINGS ON PILOT'S AND 3CM CG INDICATORS AND 3CM SEVEN-BAR DISPLAY DO NOT AGREE.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-

Check pilot's and 3CM CG Indicators (28) and (29) against 3CM seven-bar display. If one indicator misreads, renew Indicator (28) or (29). Is fault cleared?

-NO--

Renew Standby 1 CG Pack (25) for pilot's CG indicator or Standby 2 CG pack (27) for 3CM indicator. Is fault cleared?

NO

Renew Main CG Pack (24).

Chart 103

```
*******************************        --------------------------------
*CHANNEL A, 9, 10, 11 CAPTIONS*       |GROUND EQUIPMENT REQUIRED       |
*ARE NOT ILLUMINATED WHEN FQI *       |--------------------------------|
*ROTARY SWITCH IS SET TO      *       |DESCRIPTION            PART NO. |
*"MIN A" AND TEST SWITCH IS   *       |--------------------------------|
*SET TO "TEST".               *       |GROUND POWER SUPPLY  -          |
*******************************        --------------------------------

                 -----------------       ----------------
                |Renew Quantity   |     |Probe failure   |
                |Pack A (22)      |-NO--|indicated -     |
                |(MIN A and MAX A)|     |refer to        |
                |or Quantity      |     |Chart 102.      |
                |Pack B (23)      |      ----------------
                |(MIN B and MAX B)|
                 -----------------
```

Chart 104

```
********************************
*COMPARATOR CAPTIONS ARE       *
*ILLUMINATED FOR CERTAIN       *
*TANKS.                        *
********************************
```

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-

```
 -----------------         ----------------
|Is fuel distribu-|       |Renew Quantity  |
|tion correct?    |-YES-  |Pack A (22) or B|
 -----------------        |(23) as approp- |
         |                |riate. Is fault |
         |                |cleared?        |
         |                 ----------------
         |                        |
        NO                       NO
         |                        |
         |                        |
 -----------------         ----------------
|Rectify incorrect|       |Renew appropriate|
|distribution     |       |tank probe (Ref. |
|(Ref. 28-24-00). |       |Chart 102).      |
 -----------------         ----------------
```

Chart 105

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1)Circuit breaker 115 V	-	4-213	Q1354	Map ref. C1	24-50-00 R/I	28-44-00
(2)Circuit breaker 115 V	-	4-213	Q1355	Map ref. C2	24-50-00 R/I	28-44-00
(3)Circuit breaker 115 V	-	4-213	Q1356	Map ref. B1	24-50-00 R/I	28-44-00
(4)Circuit breaker 115 V	-	2-213	Q1358	Map ref. A18	24-50-00 R/I	28-44-00
(5)Circuit breaker 115 V	-	4-213	Q1357	Map ref. B2	24-50-00 R/I	28-44-00
(6)Circuit breaker 115 V	-	2-213	Q1359	Map ref. A22	24-50-00 R/I	28-44-00
(7)Circuit breaker 115 V	-	2-213	Q1360	Map ref. A23	24-50-00 R/I	28-44-00
(8)Circuit breaker 115 V	-	2-213	Q1361	Map ref. A24	24-50-00 R/I	28-44-00
(9)Contents indicator, tank 1	-	5-214	Q1031	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-01
(10)Contents indicator, tank 2	-	5-214	Q1037	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-01
(11)Contents indicator, tank 3	-	5-214	Q1047	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-01
(12)Contents indicator, tank 4	-	5-214	Q1041	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(13)Contents indicator, tank 5	-	5-214	Q1033	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-02
(14)Contents indicator, tank 5A	-	5-214	Q1039	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-02
(15)Contents indicator, tank 6	-	5-214	Q1035	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-02
(16)Contents indicator, tank 7	-	5-214	Q1045	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-03
(17)Contents indicator, tank 7A	-	5-214	Q1049	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-03
(18)Contents indicator, tank 8	-	5-214	Q1043	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-03
(19)Contents indicator tank 9	-	2-214	Q1025	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-04
(20)Contents indicator, tank 10	-	2-214	Q1027	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-04
(21)Contents indicator, tank 11	-	5-214	Q1029	3CM station (or refuel panel 1-194)	28-44-83 R/I	28-44-05

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	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
R R	(22)Quantity pack B	-	9-216	Q1342	3CM station	28-44-92 R/I	28-44-00
R R	(23)Quantity pack A	-	10-216	Q1341	3CM station	28-44-92 R/I	28-44-00
	(24)Main CG pack	-	2-216	Q1343	3CM station	28-44-81 R/I	28-44-06
	(25)Standby 1 CG pack	-	10-216	Q1344	3CM station	28-44-81 R/I	28-44-07
	(26)FQI control panel	-	5-214	Q1348	3CM station	28-44-82 R/I	28-44-07
	(27)Standby 2 CG pack	-	9-216	Q1345	3CM station	28-44-81 R/I	28-44-07
	(28)CG indicator, pilot	-	2-211	Q1347	Pilot's LH inst. panel	28-44-85 R/I	28-44-07
	(29)CG indicator, 3CM	-	5-214	Q1346	3CM station	28-44-85 R/I	28-44-07
	(30)Probes tanks 1 and 4	-	523	TANK 1		28-44-11 R/I	28-44-01
				Q1122	1		
				Q1121	2		
				Q1120	5		
				Q1123	6		
R R	Wall connector	-	193	Q1080A	FR47		20-42-54 28-44-01
			623	TANK 4			
				Q1126	1		
				Q1125	2		
				Q1124	5		
				Q1127	6		
R R	Wall connector	-	194	Q1085A			20-42-54 28-44-01
	(31)Probes, tanks 2 and 3	-	526	TANK 2		28-44-12 R/I	28-44-01
				Q1128	1		
				Q1129	2		
				Q1130	3		

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
				Q1131	4		
R	Wall connector	-	197	Q1083A	FR67		20-42-54
R							28-44-01
			626	TANK 3			
				Q1142	1		
				Q1143	2		
				Q1144	3		
				Q1145	4		
R	Wall connector	-	198	Q1088A			20-42-54
R							28-44-02
	(32)Probes, tanks 5 and 8	-	524	TANK 5		28-44-31 R/I	28-44-02
				Q1146	1		
				Q1147	2		
				Q1148	3		
				Q1149	4		
				Q1150	5		
R	Wall connector	-	193	Q1088A			20-42-54
R							28-44-02
				TANK 8 WING CELL			
				Q1112	1		
				Q1113	2		
				Q1114	3		
				Q1115	4		
				Q1116	5		
			143/ 144	TANK 8 FUSE-LAGE CELL			
				Q1117	Rear		
				Q1118	Front		
				Q1119	Centre		
	(33)Probes tanks 5A and 7A	-	527	TANK 5A		28-44-32 R/I	28-44-02
				Q1171	1		
				Q1172	2		
				Q1173	3		
				Q1174	4		
				Q1175	5		
				Q1176	6		

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
R	Wall connector	-	543	Q1084A			20-42-54
R							28-44-02
			627	TANK 7A			28-44-03
				Q1178	1		
				Q1179	2		
				Q1180	3		
				Q1181	4		
				Q1182	5		
				Q1183	6		
	(34)Probes, tanks 6 and 7	-	525	TANK 6 WING CELL		28-44-33 R/I	28-44-02
				Q1155	1		
				Q1154	2		
				Q1158	3		
				Q1157	4		
				Q1156	5		
			147/ 148	TANK 6 FUSE-LAGE CELL			
				Q1151	Rear		
				Q1152	Centre		
				Q1153	Front		
R	Wall connector	-	195	Q1082A			20-42-54
R							28-44-02
				TANK 7			28-44-03
				Q1102	1		
				Q1103	2		
				Q1104	3		
				Q1105	4		
				Q1106	5		
R	Wall connector	-	196	Q1087A			20-42-54
R							28-44-03
	(35)Probes, tank 9	-	521	LEFT CELL		28-44-51 R/I	28-44-04
				Q1109	1		
				Q1132	2		
				Q1110	3		
				Q1133	4		

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
				Q1111	5		
			621	RIGHT CELL			
				Q1096	1		
				Q1139	2		
				Q1097	3		
				Q1138	4		
				Q1098	5		
			133	FUSE-LAGE CELL			
				Q1108	Front		
				Q1137	Rear		
R	Wall connector	-	191	Q1077A			20-42-54
R							28-44-04
R	Wall connector	-	192	Q1078A			20-42-54
R							28-44-04
	(36)Probes, tank 10	-	522	LEFT CELL		28-44-52 R/I	28-44-04
				Q1159	1		
				Q1163	2		
				Q1160	3		
			622	RIGHT CELL			
				Q1165	1		
				Q1162	2		
				Q1166	3		
			141/ 142	FUSE-LAGE CELL			
				Q1161	Front		
				Q1164	Rear		
R	Wall connector	-	192	Q1090A			20-42-54
R							28-44-04
R	Wall connector	-	192	Q1091A			20-42-54
R							28-44-04
	(37)Probes, tank 11	-	311	Q1168	Left front	28-44-71 R/I	28-44-05
			312	Q1170	Right		

	ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
					front		
			311	Q1169	Left rear		
			312	Q1167	Right rear		
R	Wall connector	-	323	Q1092A			20-42-54
R							28-44-05
R	Wall connector	-	323	Q1093A			20-42-54
R							28-44-05

Component Identification
Table 101

FUEL QUANTITY INDICATION - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig.401 and 402)

   This topic details the removal/installation procedures for minor electrical components associated with the fuel quantity indication system.

   The components comprise a 54% T/O CG toggle switch on panel 1-214 at the 3CM station, and two caption light modules bearing the legend M/CG, mounted on the pilots' left and right dash panels.

2. Caption Light Module (Ref. Fig. 401)

   A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

   B. Prepare to Remove Caption Light Module

      (1) Trip the associated circuit breakers listed below and fit safety clips.

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Caption light module on sub-panel 3 of left dash panel, 2-211			
STBY 1 BOUNDARY WARN SUP	1-213	Q1367	K18
STBY 1 CG LIMITS & CG COMPN SUP	2-213	Q1361	A24
STBY 1 MACH LIMITS COMPN SUP	2-213	Q1362	B23

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Caption light module on sub-panel 2 of right dash panel, 2-212			
STBY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
STBY 2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B2
STBY 2 MACH LIMITS COMPN SUP	13-216	Q1364	D3

**ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Caption light module on sub-panel 3 of left dash panel, 2-211			
STBY 1 BOUNDARY WARN SUP	1-213	Q1367	L18
STBY 1 CG LIMITS & CG COMPN SUP	2-213	Q1361	A24
STBY 1 MACH LIMITS COMPN SUP	2-213	Q1362	B23
Caption light module on sub-panel 2 of right dash panel, 2-212			
STBY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
STBY 2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B2
STBY 2 MACH LIMITS COMPN SUP	13-216	Q1364	D3

C. Remove Caption Light Module

(1) Refer to sub-panel 3 on the pilots' left dash panel, and sub-panel 2 on the pilots' right dash panel, and identify the caption to be removed.

(2) Remove the screws securing the sub-panel to the main panel and withdraw the sub-panel sufficiently to gain access to the electrical connectors at the rear of the caption light module.

(3) Using a suitable contact removal tool, withdraw the pin inserts from the socket-type terminals in accordance with Wiring Diagram Manual, 20-42-18. Identify each cable to facilitate reconnection.

(4) At the left dash panel, disengage the clamp retaining springs at the rear of the module and withdraw the module from the front of the sub-panel and the clamp from the rear. At the right dash panel, remove the screws and nuts securing the module to the mounting plate and withdraw the module from the front of the sub-panel.

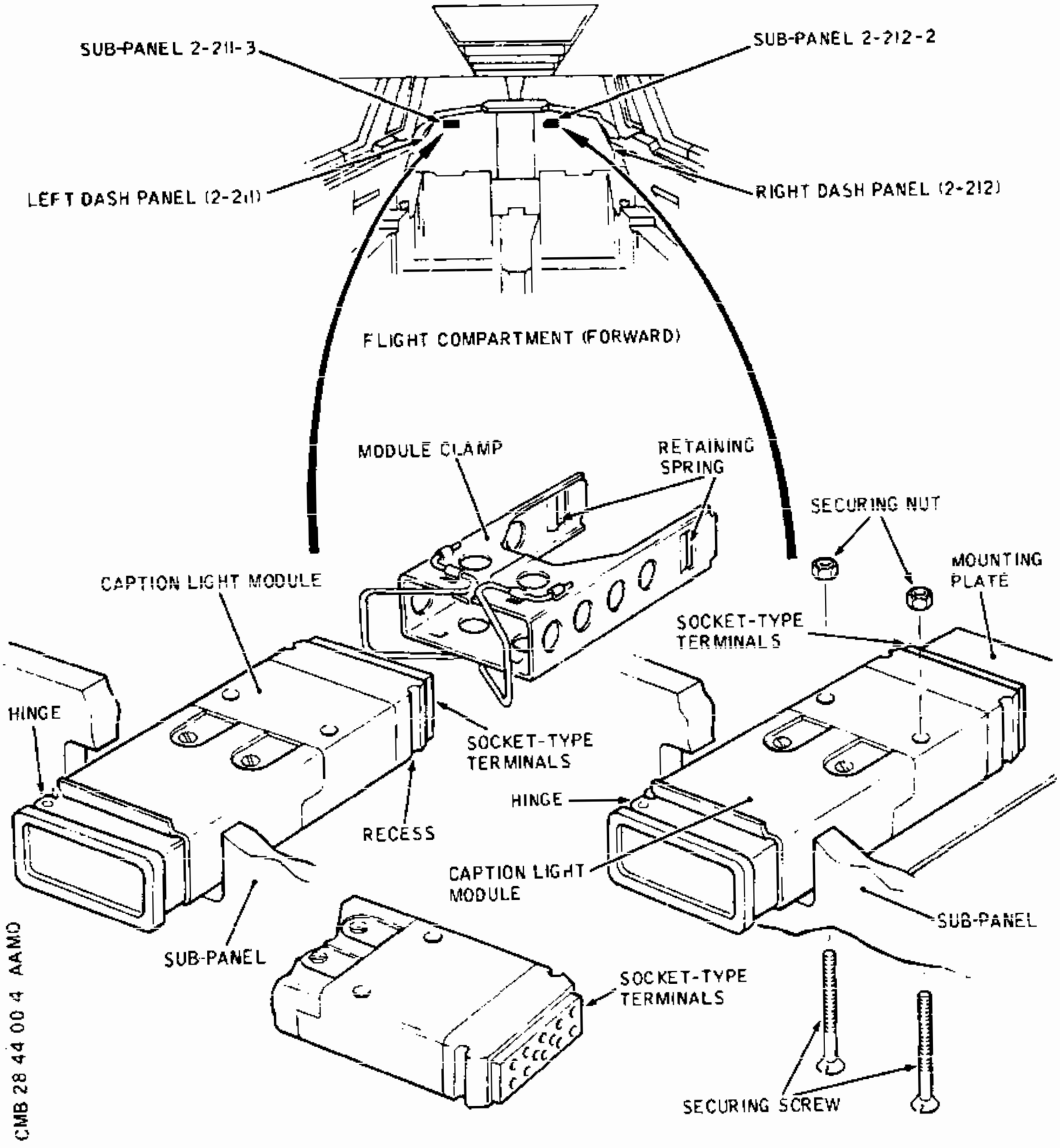
D. Install Caption Light Module

(1) Comply with the electrical safety precautions.

(2) At the left dash panel, position the clamp at the rear of the sub-panel and insert the caption light module through the aperture from the front, ensuring that the hinged edge of the module is in alignment with the white-painted line on the back of the sub-panel. Hold the module firmly against the front of the panel and press the clamp into position from the rear until the retaining springs engage the recesses in the module body.

(3) At the right dash panel, insert the caption light module through the aperture in the sub-panel, from the front, ensuring that the hinged edge of the module is in alignment with the white-painted line on the back of the sub-panel. Secure the module to the mounting plate with the screws and nuts.

(4) Using the contact insertion tool, connect the electrical cables to the module in accordance with Wiring Diagram Manual, 20-42-18, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.



Caption Light Modules - Installation
Figure 401

(5) Refit the sub-panel to its mounting on the main panel and secure it with the screws.

E. Conclusion

(1) Cancel the electrical safety precautions taken before removal and check the operation of the caption light module(s) by carrying out the appropriate test procedures.

3. 54% T/O CG Selector Switch (Ref. Fig. 402)

A. Prepare to Remove Selector Switch

(1) Isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing.

B. Remove Selector Switch

CAUTION: ELECTROLUMINESCENT (EL) PANELS ARE VULNERABLE TO DAMAGE, ESPECIALLY SCRATCHING AND CRACKING. ENSURE THAT NO DAMAGE IS CAUSED TO THE POLISHED WALLS OF EL PANELS BY TOOLS OR GENERAL HANDLING, DURING THE FOLLOWING REMOVAL/INSTALLATION PROCEDURES.

NOTE: All leads should be identified before component removal, to facilitate installation of the replacement item. If required, transfer the identification sleeves to the new leads.

(1) Gain access to the rear of panel 1-214, by releasing the quick-release fasteners and opening the panel until it is supported by the retaining cords.

(2) Trace the flying leads from the switch body to the appropriate module blocks, and release the restraining cable ties.

(3) Using the appropriate tool, release the pin inserts from the module blocks as necessary, in accordance with 20-42-18, and withdraw the flying leads from the cable looms.

(4) If necessary, loosen the two screws, which retain the transparent switch guard from the rear of the panel, sufficiently to gain access to the switch mounting nut.

(5) Using a tubular spanner, unscrew the mounting nut from the front of the panel.

(6) Remove the nut and washer and withdraw the switch, complete with the locating tabwasher, from the rear of the panel.

(7) If a replacement switch is not to be fitted immediately, retighten the switch guard securing screws, and secure the panel with the quick-release fasteners.

C. Install Selector Switch

(1) Comply with the electrical safety precautions.

(2) Screw the inner nut on to the threads sufficiently to give the required thread projection through the panel, and position the tabwasher on the threaded section with the projecting tab facing away from the switch body.

(3) Pass the switch toggle through the panel aperture and engage the tabwasher in its locating hole.

(4) Secure the switch with the mounting nut and washer.

(5) Retighten the switch guard securing screws, if previously loosened.

(6) Connect the flying leads to the appropriate module blocks as detailed in 20-27-22; ensure that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

(7) Secure the leads to the cable looms with plastic cable ties in accordance with the Wiring Diagram Manual, 20-41-09.

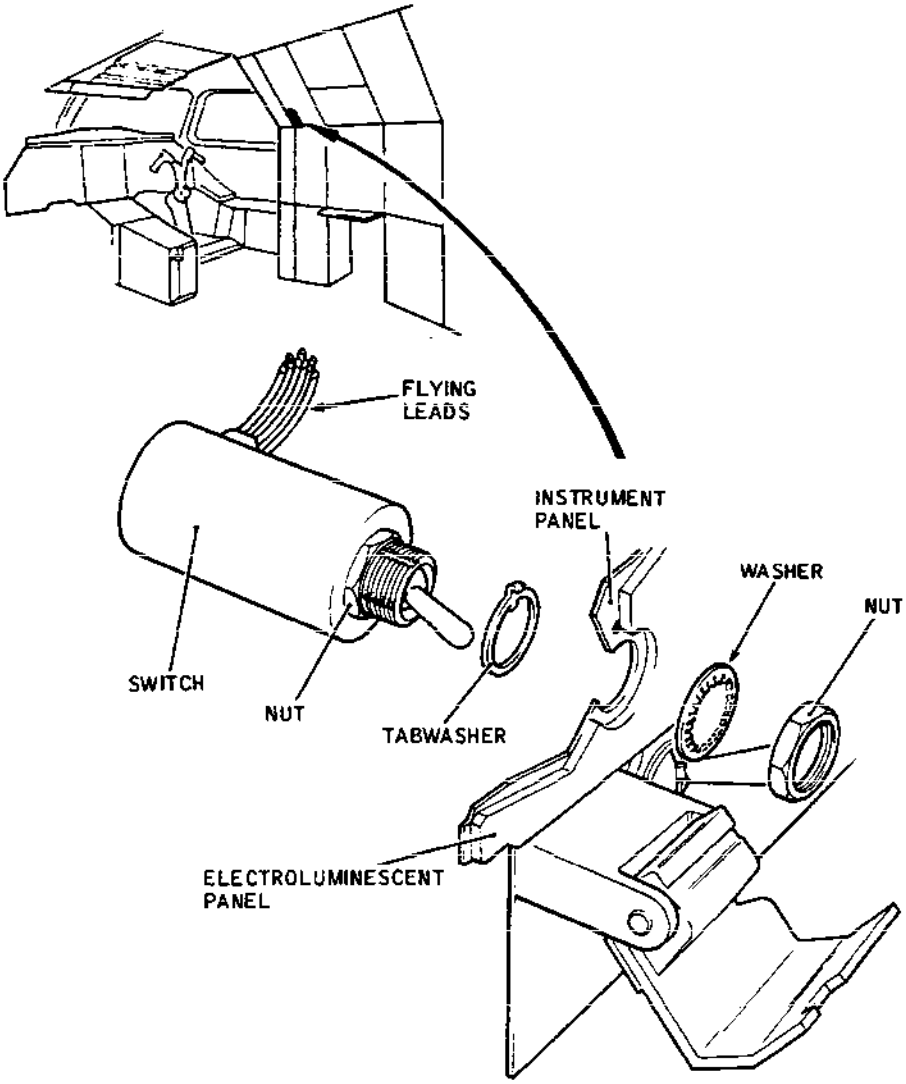
D. Conclusion

(1) Close the panel and secure it with the quick-release fasteners.

(2) Cancel the electrical isolation procedures applied before switch removal.

(3) Test the operation of the switch by performing the relevant section of the Operational Test detailed in 28-44-00, Adjustment/Test.

CB15387/00A



CMB 28 44 00 4 BAM0

\- 54% T/O CG Selector Switch - Installation
Figure 402

FUEL QUANTITY INDICATION - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The following Operational Test and Functional Test prove the integrity of the fuel quantity indication (FQI) system, and associated failure warnings. A System Test is not considered necessary in this application.

2. Operational Test (Ref. Fig. 501)

A. Prepare

(1) Check that on the fuel contents indicators, the fuel totaliser and CG indicators (at the pilots' and 3CM stations) the failure warning flags are showing, and on the pilots' machmeters the CG flags have appeared in the aperture windows.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Refer to the aft centre console and switch on ADC 1 and ADC 2, with the two rotary test switches set to "NORM".

NOTE: If an ADC caption is illuminated it must be pressed to reset the circuit.

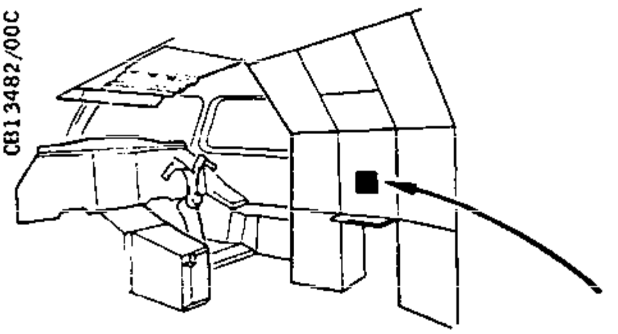
(4) Test the red M/CG warning caption filaments and the CG indicator warning light filaments as detailed in 33-14-00.

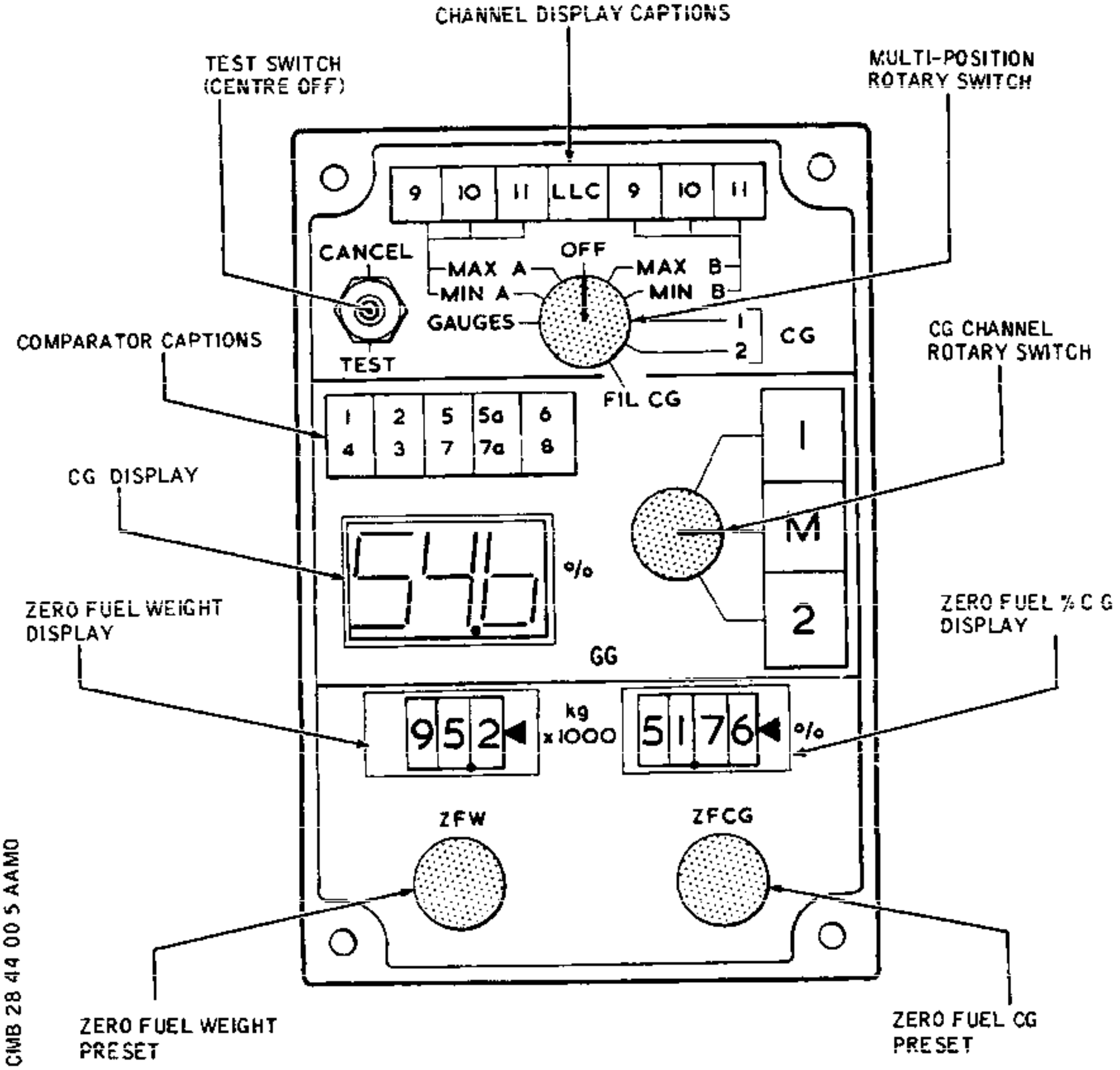
B. Test FQI System

(1) Check that on the appropriate indicators the failure warning flags are withdrawn, and on the pilots' machmeters the CG flags are withdrawn and there are no warnings apparent on the FQI control panel, or the pilots' instrument panels.

(2) Check that both test switches are at OFF, the CG channel selection switch is at M and no boundary warning lamps are lit.

NOTE: During the test, only the lamps stated must be lit.





R

FQI Control Panel
Figure 501

(3) Check the operation of the 'presets' associated with the ZFCG and ZFW as follows:-

CAUTION: THE ZFCG 'PRESET' IS LIMITED MECHANICALLY TO THE RANGE 50 TO 55 % CO; ANY ATTEMPT TO ATTAIN SETTINGS OUTSIDE THIS RANGE WILL, THEORETICALLY, CAUSE THE CLUTCH MECHANISM TO SLIP. THIS ACTION MUST BE AVOIDED AS IT IS INADVISABLE TO FORCE THE LIMIT STOPS.

NOTE: For this part (paragraph (3)) of the
R test, when aircraft "D" checks are per-
R formed, the fuel tanks must be empty, except for 300 kg in each of the collector tanks (1, 2, 3 and 4).

R For all other checks (e.g. after
R replacement or renewal of the F.Q.I.
R control panel) it is acceptable if
R the tank capacitance is simulated by
R means of the test set (or equivalent).

(a) Set each collector tank fuel indicator to read 300(±30) kg.

(b) Set the Zero Fuel CG (ZFCG) preset located on the FQI control panel to read 52.50 % Co, and note that this is indicated on the pilots' and 3CM CG indicators as well as on the FQI panel seven-bar display.

(c) Set the Zero Fuel Weight (ZFW) preset to read 85,870 kg.

(d) Repeat operation (b) but with the ZFCG preset set to read the following:-

53.0 % Co, 54.0 % Co and 55.0 % Co.

(e) With the ZFCG preset set to read 52.5 % Co, set the ZFW preset to read the following quantities:-

76,000 kg, 80,000 kg, 82,000 kg, 88,000 kg and 92,000 kg.

NOTE: For each setting of the ZFW, the pilots' and 3CM CG indicators should show nominal readings of 52.5 % Co and the seven-bar display should agree with that recorded in operation (b).

(4) Set the multi-position rotary (MPR) switch to "GAUGES" and the test switch to "TEST" and check

that the following conditions are met:-

NOTE: Each tank indicator must read greater than zero to ensure that the capacitance index compensators (CICs) are immersed in fuel.

(a) The individual contents indicator readings show the following increases:-

Tanks 1, 2, 3, 4, 5A and 7A	-	200(±50) kg
Tanks 5, 6, 7 and 8	-	500(±100) kg
Tanks 9 and 10	-	500(±150) kg
Tank 11	-	3,000(±200) kg

NOTE: No comparator warnings must be present for tanks 9, 10 and 11.

(b) The digital readout of the totaliser (total contents) indicators (pilots' and 3CM) is increased by approx. 7,200 kg (the sum total of the error value of the contents indicators).

(c) The CG indicator readings (pilots' and 3CM) show an aft movement of approx. 1 per cent.

(d) The limit bugs on the pilots' machmeters are repositioned.

(5) Release the TEST - CANCEL switch and check that -

(a) all the indicators and limit bugs assume their original settings, and

(b) any boundary warnings are cancelled.

(6) If any master warnings are activated, cancel them (Ref. 33-15-00).

(7) Set the ADC 1 and ADC 2 switches to "ON".

(8) On the FQI control panel, set the MPR switch to "MIN A".

(9) Set the test switch to "TEST" and check that the 9, 10 and 11 channel A captions are illuminated within 6(±1) s.

(10) Move the test switch to "CANCEL" and check that the 9, 10 and 11 captions are extinguished; release the test switch.

(11) Set the MPR switch to "MAX A".

(12) Hold the test switch at "TEST" and check that the 9,

10 and 11 channel A captions are illuminated within 1.5(±0.5) s.

(13) Repeat operation (10).

(14) Set the MPR switch to "MIN B" and "MAX B", in turn, and check that the channel B tanks 9, 10 and 11 captions are illuminated within the time limit specified in operations (9) and (12).

(15) Repeat operation (10).

(16) Release the FQI control panel test switch to the centre-off position; check that all the indicators and limit bugs assume their original settings, and that the warnings are cancelled.

After SB 28-056 For A/C 001-007,

NOTE: For the section of the test comprising operations (17) to (25) inclusive, a test of one channel only is necessary.

(17) Refer to 3.B.(1) and trip the appropriate circuit breakers to electrically isolate the channel A (LH) quantity pack; fit safety clips.

(18) Gain access to the channel A quantity pack Q1341 and disconnect the electrical connector Q1341A (Ref. 28-44-92).

(19) Reset the circuit breakers tripped in operation (17).

(20) Check that on the FQI control panel the channel A tanks 9, 10 and 11 captions are illuminated.

(21) Set the MPR switch to "MAX A" and operate the "TEST - CANCEL" switch six to eight times at 1 s intervals.

NOTE: This action will reposition the pointers of the tanks 9, 10 and 11 contents gauges.

(22) Check that after 25(+or-10) s, the 9, 10 and 11 channel A and B captions are illuminated.

(23) Repeat operation (17) and connect the electrical connector Q1341A to the quantity pack Q1341

(Ref. 28-44-92).

(24) Reset the circuit breakers tripped in operation (23).

(25) Set the "TEST - CANCEL" switch to "CANCEL"; release the switch and check that all warning lights are extinguished.

(26) Set the MPR switch to "OFF".

(27) Check that the CG channel selector switch is set to M (illuminated white).

(28) Set the MPR switch to "1 CG" and the test switch to "TEST" and check that -

R (a) the five main comparator captions 1-4, 2-3, 5-7,
R 5A-7A and 6-8 do not illuminate, but

R (b) the channel A 11 caption is illuminated yellow.
R Channels A9 and A10 may illuminate, but depending
R on system tolerances.

(29) Set the test switch to "CANCEL" and release it.

R (30) Set the MPR switch to "2 CG", and repeat operation
R (28) in toto, but check that the channel B 11 caption
R is illuminated yellow.
R Channels B9 and B10 may illuminate, but depending on
R system tolerances.

(31) Set the test switch to "CANCEL" and release it.

(32) Note the reading when M is selected, and ensure that at positions 1 and 2 the CG readouts are within ±0.2 % Co of each other; reselect "M".

(33) Set the MPR switch to "FIL CG" and check that the seven-bar % CG indicator display on the FQI control panel reads 88.8.

(34) Set the MPR switch to "OFF" and check that the % CG readout returns to the original figure.

(35) Ensure that the test switch has returned to the centre-off position, and that all warnings are cancelled.

(36) Refer to the refuel panel 1-194 (Ref. 28-24-00).

(37) Set the refuel master switch to "SET-UP" and check that all the indicator failure warning flags are withdrawn.

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R (38) Operate the "FQI TEST" push-switch and check that the indicator readings show the increased quantities detailed in paragraphs (4)(a) and (b).

R (39) Release the test switch and verify that the original indicator readings are restored.

R (40) Return the refuel master switch to "OFF".

R (41) Return the ADC 1 and ADC 2 selector switches to "OFF".

C. Test Boundary Warnings and Stick Shaker

(1) Ground Condition Test at 0.25 M

NOTE: This version of the test is for aircraft before Service Bulletin 28-012 only.

(a) Set the ADC 1 and ADC 2 rotary selector switches to "NORM".

(b) Set the ADC 1 and ADC 2 ON - OFF switches to "ON".

(c) On the FQI control panel rotate the ZFCG preset to move the CG from its existing value (assumed to be 53 % Co) toward the AFT boundary.

(d) Check that when a CG readout of 53.8(±0.2) % Co is attained, the normal AFT boundary warnings are activated, lighting the pilot's and 3CM CG indicator warning lamps and illuminating the red M/CG captions on the pilot's and co-pilot's left and right instrument panels, and a red master warning M/CG caption, accompanied by a single-stroke gong.

(e) On the FQI control panel set the MPR switch to "GAUGES", then with the TEST - CANCEL switch held in the "TEST" position rotate the ZFCG preset until the extreme AFT boundary alarms are activated (Ref. para.(d)).

NOTE: The GAUGES test position is utilized to extend the range of the ZFCG preset.

(f) Cancel the warning by releasing the TEST - CANCEL switch to the centre-off position and setting the MPR switch to "OFF"; cancel the master warnings (Ref. 33-15-00).

(g) Using the ZFCG preset, move the CG toward the FWD boundary to activate the normal and extreme warnings at 51.8(±0.2) % Co, and 51.3(±0.2) % Co, accompanied by the warnings defined in paragraph (d), except that in the extreme FWD boundary warning configuration the CG indicator and red M/CG captions flash on and off, repeatedly.

NOTE: It may be necessary to operate the ZFW preset to extend the CG range to activate the extreme FWD boundary warning.

(h) Reset the CG to its original reading to cancel the warnings.

After SB 28-012 For A/C 001-007,

(1) Ground Condition Test at 0.25 M

(a) Set the ADC 1 and ADC 2 rotary selector switches to "NORM".

(b) Set the ADC 1 and ADC 2 ON - OFF switches to "ON".

(c) On the FQI control panel rotate the ZFCG preset to move the CG from its existing value (assumed to be 53 % Co) toward the AFT boundary.

(d) Check that when a CG readout of 53.8(±0.2) % Co is attained, the normal AFT boundary warnings are activated, lighting the pilot's and 3CM CG indicator warning lamps and illuminating the red M/CG captions on the pilot's and co-pilot's left and right instrument panels, and a red master warning M/CG caption, accompanied by a single-stroke gong.

(e) Refer to panel 1-214 and set the T/O CG toggle switch to "54 %".

(f) Check that the boundary warnings are cancelled.

(g) Refer to panel 2-214; set the tank 9 trim pump control switches (left and right) to "ON".

(h) Check that on panel 1-214 the T/O CG selector switch has returned to the NORM (up) position,

and that the boundary warnings are repeated.

(i) Return the tank 9 trim pump control switches to the "AUTO" position.

(j) Repeat operations (e) to (i), but in operations (g) and (i) for tank 9 read tank 10.

NOTE: A further proof test can be performed using tank 9 left switch with tank 10 right switch, and tank 10 left switch with tank 9 right switch. (Ref. 28-23-00).

(k) On the FQI control panel set the MPR switch to "GAUGES", then with the TEST - CANCEL switch held in the "TEST" position rotate the ZFCG preset until the extreme AFT boundary alarms are activated (Ref. para.(d)).

NOTE: The GAUGES test position is utilized to extend the range of the ZFCG preset.

(l) Cancel the warning by releasing the TEST - CANCEL switch to the centre-off position and setting the MPR switch to "OFF"; cancel the master warnings (Ref. 33-15-00).

(m) Using the ZFCG preset, move the CG toward the FWD boundary to activate the normal and extreme warnings at 51.8(±0.2) % Co and 51.3(±0.2) % Co, accompanied by the warnings defined in paragraph (d), except that in the extreme FWD boundary warning configuration the CG indicator and red M/CG captions flash on and off, repeatedly.

NOTE: It may be necessary to operate the ZFW preset to extend the CG range to activate the extreme FWD boundary warning.

(n) Reset the CG to its original reading to cancel the warnings.

(2) Ground Condition Test at 0.63 M

R NOTE: An aircraft angle of incidence of 21.5 deg is simulated for this test.

(a) Set the ADC 1 rotary selector switch to "1" and check that the following conditions are met:-

a1) The stick-shaker is activated, accompanied by an audible warning (Ref. 27-28-00).

NOTE: If necessary the stick-shaker may be cancelled by tripping the STICK SHAKER SUP circuit breaker W513, map ref.P15, on panel 1-213.

a2) The ADC 1 blue TEST caption is illuminated.

a3) The overspeed audio warning, a warbling tone repeated, is activated if the droop nose is lower than 5 deg; press the TEST caption to cancel the warning.

a4) The ADC 1 amber caption is illuminated; press to cancel it.

a5) The ADS red master warning is activated, accompanied by a single-stroke gong; cancel the master warning.

(b) Using the ZFCG preset, move the CG toward the AFT boundary until at 54.8(±0.2) % Co the normal AFT boundary warnings are activated (Ref. para.(1)(d)).

(c) Continue to rotate the ZFCG preset and the GAUGES test if necessary (Ref. NOTE following para.(1)(e)) and check that at 55.2(±0.2) % Co the extreme AFT boundary warning is activated.

(d) Verify the stick-shaker operation by resetting the STICK SHAKER SUP circuit breaker, W513, map ref.P15, on panel 1-213.

R (e) Set the ADC 1 TEST rotary selector switch to "NORM", then press the amber ADC 1 TEST caption and check that the stick-shaker continues to operate, accompanied by the pilots' flashing CG indicator warning light, and red M/CG caption.

(f) Trip the circuit breaker set in operation (d) to cancel the warnings.

(g) Set the ADC 1 TEST selector switch to "1" and cancel the remaining warnings by rotating the ZFCG preset to reduce the CG reading to 54.6 % Co; use the GAUGES test facility as necessary.

(h) Release the TEST - CANCEL switch to the centre-off position.

(i) Return the MPR switch to "OFF", then rotate the ZFW and ZFCG presets to reset the CG to 53 % Co.

(j) Set the ADC 1 TEST selector switch to "1" to cancel any remaining warnings, then set it to "NORM".

(k) Using ADC 2, repeat operations (a) to (j); check that in operation (e) the flashing sequence is applied to the co-pilot's M/CG caption, and the 3CM CG indicator.

D. Conclusion

(1) Check that all warning captions, associated with the FQI system and the ADC system, on the pilots' and 3CM instrument panels are extinguished. If necessary cancel any illuminated captions.

(2) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(3) Check that the failure warning flags have appeared on the fuel contents indicators and the fuel totaliser and CG indicators at the pilots' and 3CM stations, and on the ground refuel panel, as appropriate.

(4) Close and secure the refuel panel access door.

3. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
FQI simulation test set	TE 5053 (Amendment 5)
Test looms Q1341 and Q1342	-
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate the channel A (LH) and channel B (RH) quantity packs by tripping the associated circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKERS	MAP REF.
Channel A (LH) quantity pack			
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
Channel B (RH) quantity pack			
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C2
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18

(2) Remove the appropriate cover from the RH equipment racking and identify the channel A quantity pack Q1341 (LH) on shelf 10-216 and the channel B quantity pack Q1342 (RH) on shelf 9-216.

(3) Disconnect the electrical connectors, identified A and B, from the front faces of the packs.

(4) Connect the test loom connectors, identified Q1341 A and B(LH), to the appropriate connectors on quantity pack A; connect the test loom connectors, identified Q1342 A and B(RH), to the appropriate connectors on quantity pack B.

CAUTION: USE EXTREME CARE WHEN CONNECTING/DISCONNECTING QUANTITY PACK CO-AXIAL CONNECTORS.

(5) Connect the test loom connectors, identified PL 1, 2, 3 and 4, to the test connectors SK 1, 2, 3 and 4 on the test set. Connect the test set GND lead to a suitable earthing point on the equipment racking.

(6) Reset the circuit breakers tripped in operation (1).

(7) Make available electrical ground power as detailed in 24-41-00.

C. Test Collector Tank Underfull Function

(1) Using the test set, set the contents of each of the collector tanks 1, 2, 3 and 4 to read 1,100 kg.

(2) On the pilots' centre instrument panel 6-211 and the 3CM fuel management panel 5-214, check that the total fuel contents indicator failure flags are withdrawn.

(3) Using the test set, reduce the contents of tank 1 to 800 kg, and note that the total contents indicator failure flags remain withdrawn.

(4) Reduce the contents reading for tank 4 and check that -

(a) the failure flags have appeared on the pilots' and 3CM total fuel contents indicators, and

(b) the indicators have ceased to function.

(5) Restore the contents readings for each of tanks 1 and 4 to 1,100 kg and check that -

(a) the total fuel contents indicator failure flags are withdrawn, and

(b) the indicators are functioning normally.

D. Test Multiple CG Channels (1-M-2) Failure Warning

(1) On the FQI control panel:

(a) Set the ZFW preset to 85,870 kg.

(b) Set the ZFCG preset to 52.5 % Co.

(2) Using the test set, set the contents indicators for all the tanks to read zero; note the position of the setting knob for tank 2.

(3) Set the contents indicators for tanks 2 and 3 to read 4,000 kg.

(4) On the FQI control panel check that all the comparator and c.g. channel captions are extinguished, and the c.g. channel switch is set to M.

(5) Check that the failure warning flags on the pilot's and 3CM CG indicators, and the CG flags on the pilot's machmeters are withdrawn.

(6) Cancel any master warnings.

(7) Trip the TANKS 1 & 2 FQI SUP circuit breaker Q1360, on panel 2-213, map ref.A23.

(8) Turn the test set setting knob for tank 2 (TK2) to the position previously noted in operation (2) to correspond with an indicator zero reading.

(9) Reset the circuit breaker tripped in operation (7); then check that on the FQI control panel the tanks 2-3 comparator caption and the amber c.g. 1 caption are illuminated.

(10) Using the test set, slowly increase the reading on the tank 7A contents indicator to 5,000 kg, and check that -

(a) the amber 1-M-2 c.g. channel captions are illuminated amber, accompanied by an amber CG master warning and single stroke gong,

(b) the failure warning flags have appeared on the pilot's and 3CM CG indicators, and

(c) the CG flags have appeared on the pilots' machmeters.

NOTE: If this operation is performed too rapidly, the tanks 5A-7A comparator caption will be illuminated. If this occurs the contents indicator reading must be reset to zero, the comparator caption extinguished by the operation of the TEST - CANCEL

switch, and the operation repeated, only more slowly.

(11) Reset the tank 2 contents indicator reading to 4,000 kg and the tank 7A reading to zero.

(12) Using the TEST - CANCEL switch on the FQI control panel, extinguish the tanks 2-3 comparator caption and check that the 1-M-2 amber captions are extinguished.

(13) Check that the amber CG master warning is cancelled, and that the failure flags detailed in operation (10) are withdrawn.

E. Test LLC Warning

(1) Check that on the FQI control panel the LLC caption is extinguished.

(2) Using the test set, set each contents indicator for tanks 9, 10 and 11 to read 500 kg.

(3) On the fuel management panel, set the tank 11 quantity selector to 8,000 kg, and the tanks 9 and 10 quantity selector to read zero.

(4) On the test set, slowly adjust the tank 11 indicator to read 4,000 kg, and check that the LLC caption remains extinguished.

(5) Refer to 28-23-71, Removal/Installation, and gain access to the rear of the tank 11 quantity selector.

NOTE: For operations (6)and (7) it will be necessary for electrical power supplies to be connected to the quantity selector.

(6) Observing the electrical safety precautions, disconnect the channel A potentiometer supply electrical connector Q410-A from the tank 11 quantity selector, and check that the LLC caption is illuminated.

(7) Reconnect the connector and check that the LLC caption is extinguished.

(8) Disconnect the channel B potentiometer connector Q410-B from the tank 11 quantity selector, and again check that the LLC caption is illuminated.

(9) Reconnect the connector and check that the LLC caption is extinguished.

(10) Reinstall the tank 11 quantity selector as detailed in 28-23-71, Removal/Installation.

F. Test Dual Channel Tank Comparators

(1) Using the appropriate knob on the test set, set each contents indicator to read sufficiently above zero to clear the failure warning flag, and so avoid driving the motor against the clutch.

(2) Cancel any M/CG master warning by pressing the M/CG warning caption.

(3) On the FQI control panel, set the TEST - CANCEL switch to "CANCEL" and check that all the twin tank comparator captions are extinguished.

(4) Rotate the MPR switch to "MAX A", set the TEST - CANCEL switch to "CANCEL", then release it, and check that all 9, 10, 11 channel A captions are extinguished.

(5) Repeat operation (4) with the MPR switch at "MAX B".

<u>NOTE</u>: If any twin tank comparator captions are not extinguished during this test, cancellation may be facilitated by utilizing operation (6).

(6) Refer to panel 6-214 and set the lights test and dimming switch to "TEST" (Ref. 33-14-00); at the same time set the FQI control panel TEST - CANCEL switch to "CANCEL". Release both switches and check that all captions are extinguished.

(7) On the test set check that the channels A and B TEST - NORMAL selector switches are set to NORMAL.

(8) Using the appropriate test set knobs, set the contents of tanks 9, 10 and 11 to "8,000 kg" (8T engraving on the setting knobs).

(9) Check that, on the FQI control panel, the associated comparator captions are extinguished. If necessary, to extinguish the captions, rotate the MPR switch to "MAX A" or "B", as appropriate; set the TEST - CANCEL switch to "CANCEL" and release it.

(10) Set the test set channel A TEST - NORMAL switch to

"TEST" and check that the channel A 9, 10, 11 failure captions are illuminated within 10 s.

(11) Set the channel A TEST - NORMAL selector switch to "NORMAL"; cancel the warnings as detailed in operation (9).

(12) Using the channel B TEST - NORMAL selector switch, repeat operations (10) and (11) for the channel B 9, 10, 11 captions.

G. Test Twin Tank Comparator Dead Band Tolerance

(1) Using the appropriate knobs on the test set, set each of tanks 1, 2, 3, 4, 5, 5A, 6, 7, 7A and 8 to greater than 22 per cent full scale deflection (FSD) (1/4 engraving on setting knob), so that the twin tank pairs 1-4, 2-3, 5-7, 5A-7A, 6-8 are equal.

(2) On the FQI control panel, set the TEST - CANCEL switch to "CANCEL" and check that all twin tank comparator captions are extinguished.

(3) Rapidly rotate the setting knobs for tanks 1, 2, 5, 5A and 6 as far as, but not beyond, the zero mark. Check that the appropriate comparator caption for each pair of tanks is illuminated when the indicator has run to zero.

(4) Restore the contents indicators to the readings achieved in operation (1). Set the FQI control panel TEST - CANCEL switch to "CANCEL"; then release it and ensure that all the comparator captions are extinguished.

(5) Repeat operation (2) for tanks 3, 4, 7, 7A and 8.

H. Conclusion

(1) Check that all FQI system warning captions on the pilots' instrument panels and the FQI control panel are extinguished; if necessary, cancel any illuminated captions.

(2) Trip the circuit breakers previously reset in operation B.(6).

(3) Disconnect the test looms from the test set and the quantity packs; remove the test set from the aircraft.

(4) Observe the CAUTION detailed in operation B.(4) and

connect the appropriate co-axial connectors to the front faces of the quantity packs.

(5) Fit the furnishing covers to the RH equipment racking.

(6) Reset the circuit breakers tripped in operation (2) and perform an Operational Test of the FQI system as detailed in paragraph 2.

END OF THIS SECTION

NEXT

PROBES, TANKS 1 AND 4 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General (Ref. Fig.401, 402 and 403)
(Ref. Fig.404)

Six probes are installed in each of tanks 1 and 4. In the removal/installation instructions detailed in this topic the probes are numbered from 1 to 6, for clarity, together with their electrical identification numbers (Ref. Table 401).

The probes in tank 4 fulfil the same functions as, and are installed at locations similar to, the probes in tank 1. Because of the installed angles of probes 1 and 6, and probe 4 (full length dummy probe), guide chutes are provided to facilitate probe installation. Receptacles are installed in the wing bottom surface to act as guides for probes 2 and 5. Probe 3 is a short dummy probe, bracket-mounted internally near the top of the tank. All the probes are accessible from the wing top surface, with the exception of the dummy probe 3, which is accessible only from inside the tank and removal necessitates tank draining.

All electrical wiring and connections are internal, but for probes 1, 2, 4, 5 and 6 are made with the probes partially removed from the tank. Removal of these probes may necessitate partial draining of the tanks, due to the wing profile.

Probes 1 and 5 are simple fuel quantity indication (FQI) probes. Probe 2 carries an overfull level sensor, probe 6 accommodates an overfull level sensor and a capacitance index compensator (CIC). Dummy probe 3 provides a mounting for overfull and high level sensors. Dummy probe 4 carries underfull and low level sensors.

In the following procedure the 'Equipment and Materials' 'Prepare to Install Probe' and 'Conclusion' paragraphs are applicable to all probes.

**ON A/C 001-006,

NOTE: FQI Probe Connections

B It is imperative that the tightening methods laid down in
B the Maintenance Manual are adhered to.

B Physically check the cable terminations for movement to
B ensure that it is effectively clamped.

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2. Probes

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-

B. Prepare to Remove Probe

(1) If the dummy probe is to be removed, defuel the tank as detailed in 28-25-00, and gain access to the tank as detailed in 28-10-00. For the remaining probes defuel the appropriate tank consistent with the probe location.

(2) Ensure that the ground refuel panel 1-194 is closed.

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switch is inadvertently operated.

(4) Isolate the electrical supplies to the probe by tripping the appropriate circuit breakers. Fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected, it is suggested that all circuit breakers listed are tripped, for both tanks 1 and 4, irrespective of the probe location.

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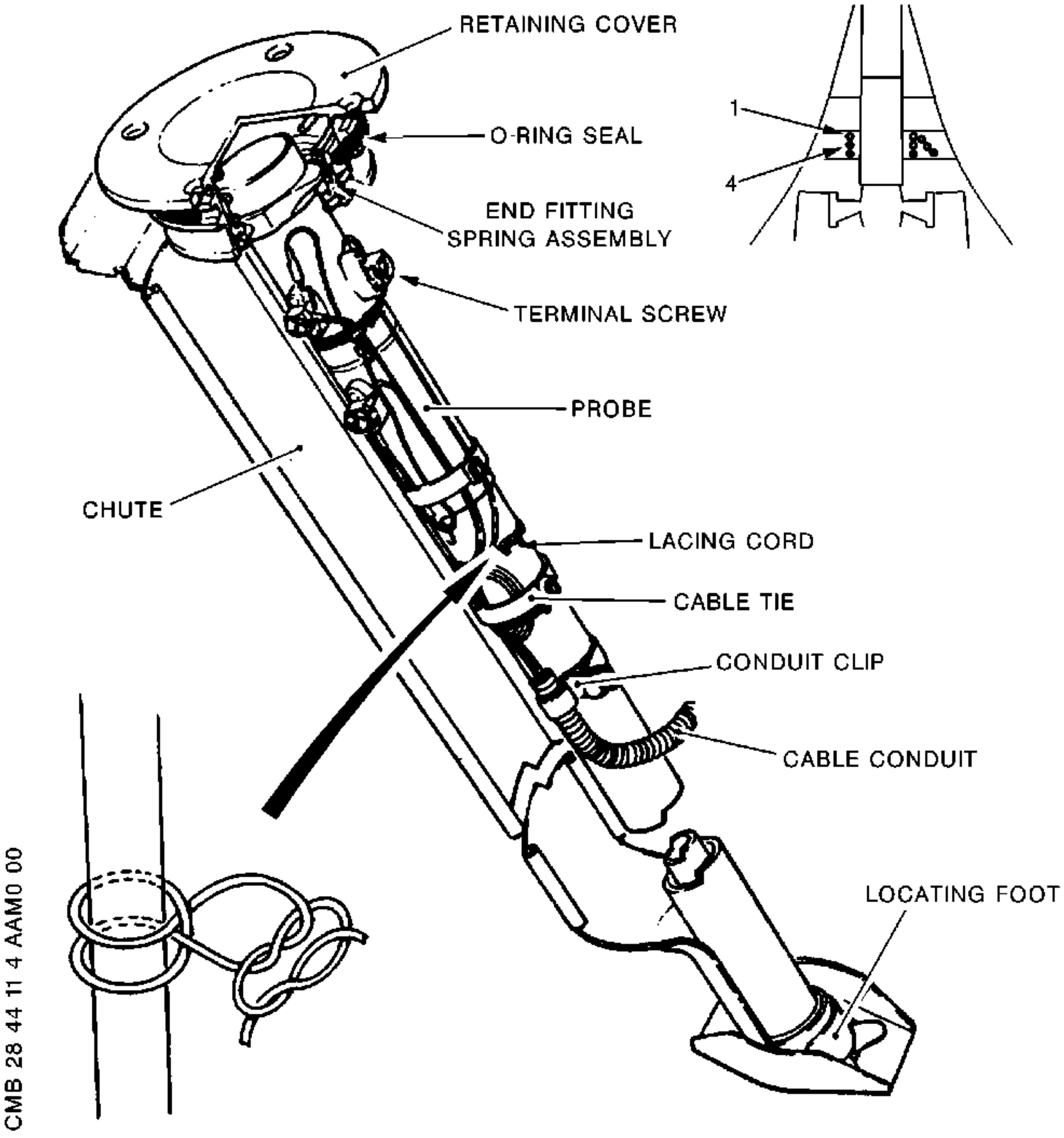
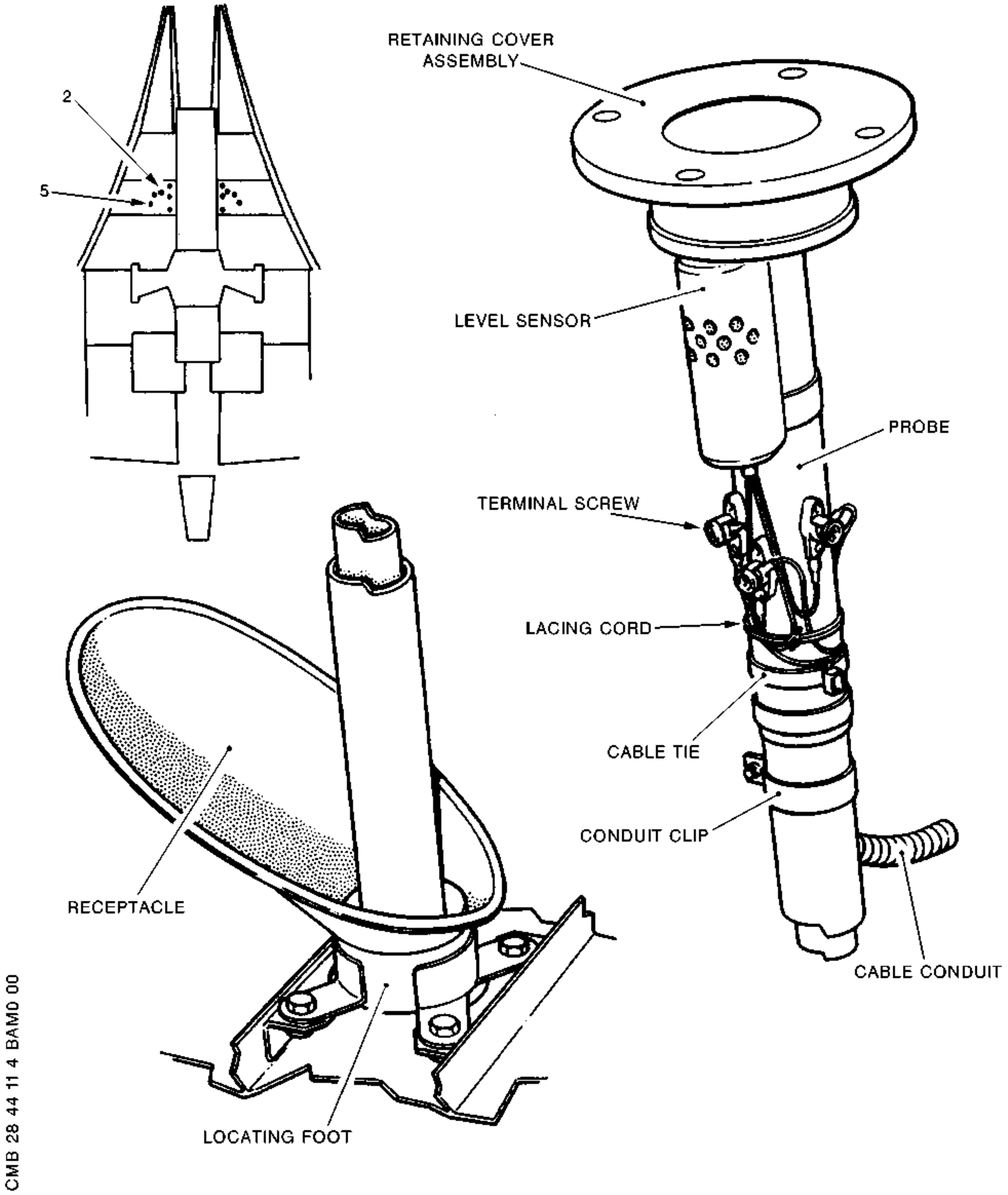


Probes 1 and 4 - Installation
Figure 401



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Probes 2 and 5 - Installation
Figure 402

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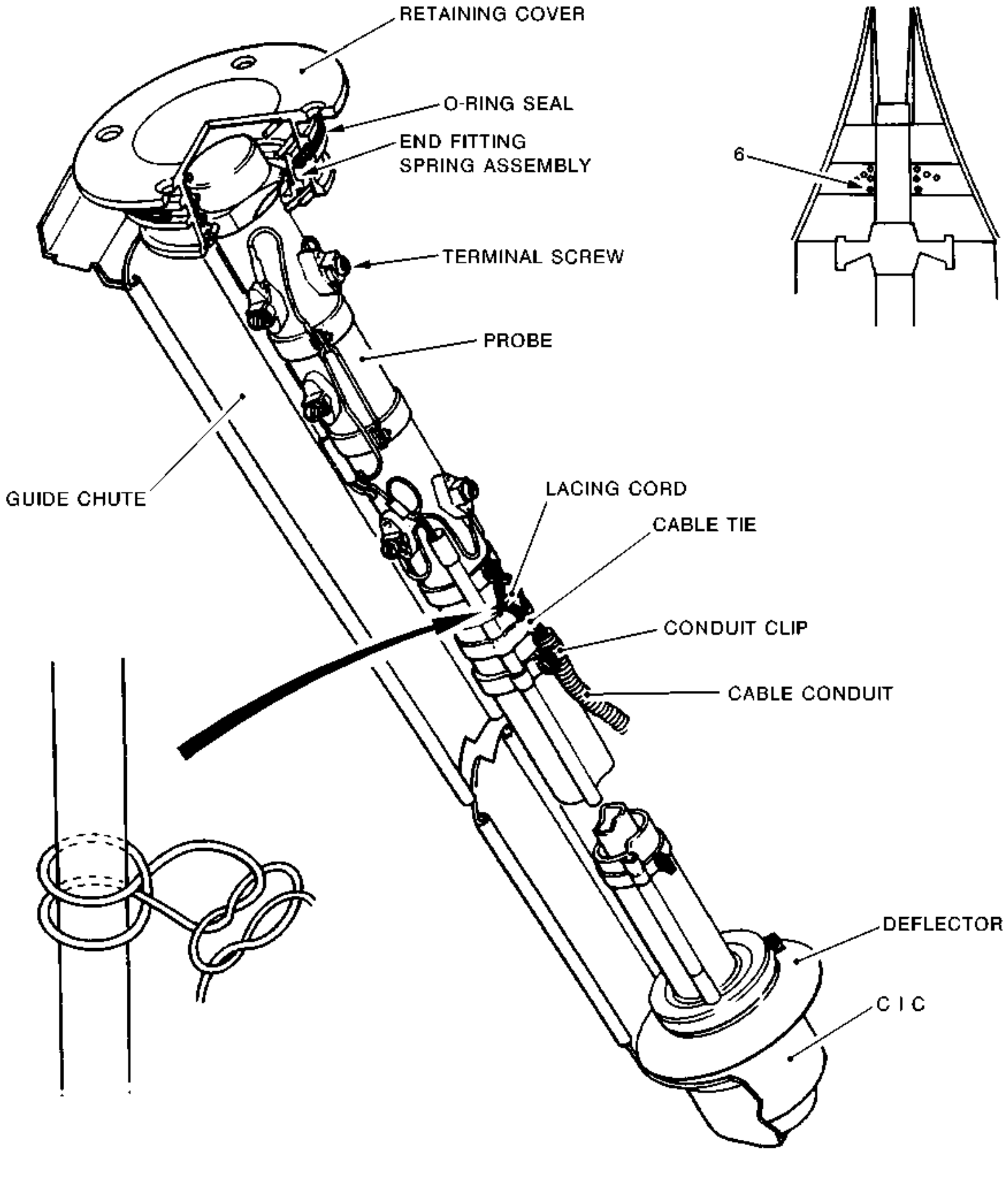

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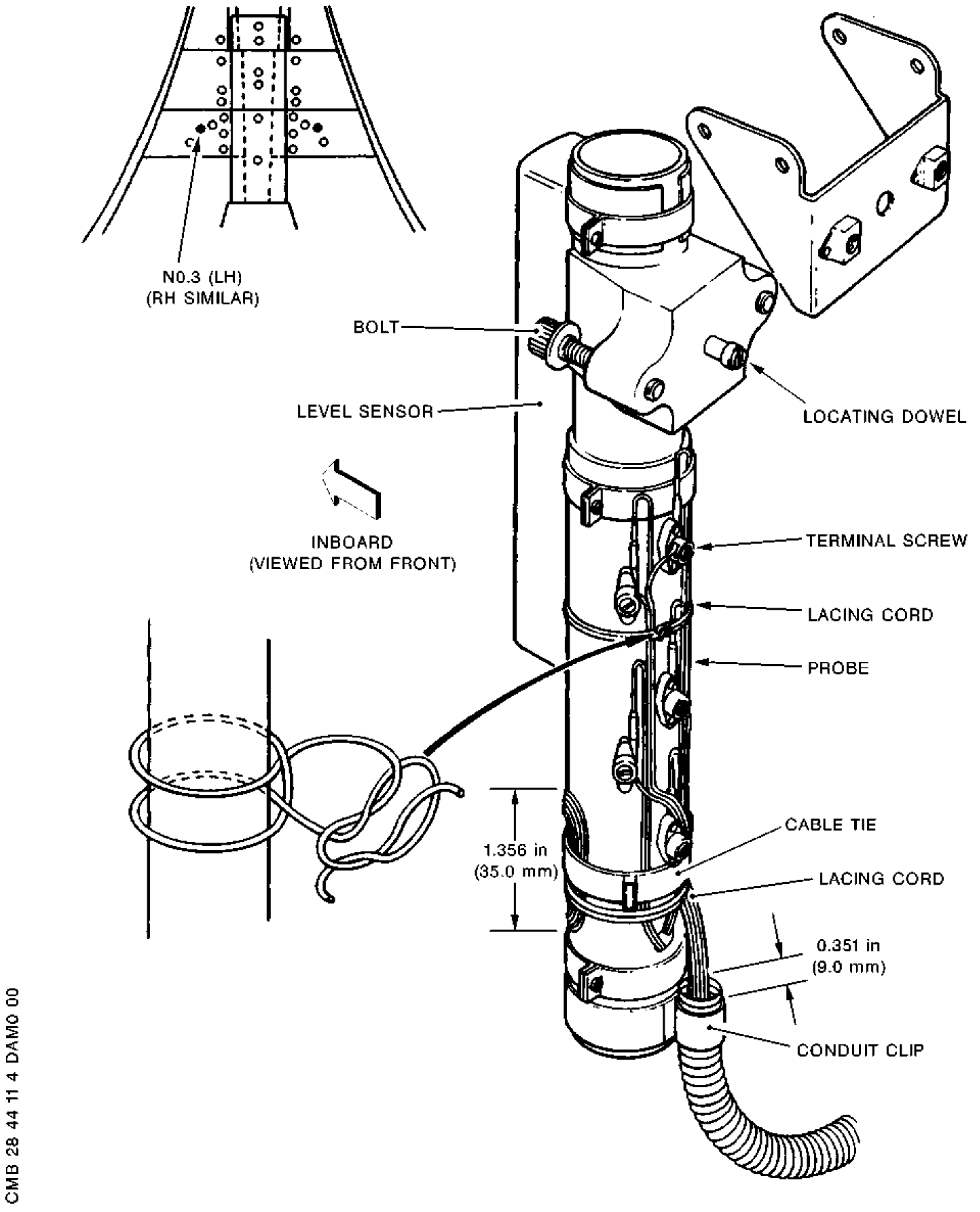
Probe 6 - Installation
Figure 403



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Dummy Probe 3 Installation Details
Figure 404

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F 8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D 5
TANKS 1 & 2 UF TANKS 3 & 4 LL SUP & IND	3-213	Q1220	D 6
TANKS 3 & 4 UF TANKS 1 & 2 LL SUP & IND	1-213	Q1221	J16
TANKS 3 & 4 FQI SUP	4-213	Q1354	C 1
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23

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C. Remove Probes 1, 2, 4, 5 or 6 (Ref. Fig.401, 402 and 403) (Ref. Fig.406)

NOTE: Due to the restricted length of the free conduit between the tank harness and the conduit clip on the probe, two operators may be required to perform the necessary electrical disconnection operations for probe removal.

(1) Refer to Table 401 to identify the probe to be removed. The probes are identified front to rear, left cell and right cell.

PROBE LOCATION	PROBE IDENT. LEFT CELL	PROBE IDENT RIGHT CELL
1	Q1122	Q1126
2	Q1121	Q1125
3	Q1332	Q1333
4	Q1208	Q1207
5	Q1120	Q1124
6	Q1123	Q1127

Probe Identification
Table 401

NOTE: Before a probe is removed, the position of the retaining cover in relation to the surrounding structure should be noted, to aid installation.

(2) Unscrew the retaining bolts sufficiently to clear the threads, then ease the retaining cover, together with the bolts and the O-ring seals, from the tank sufficiently to ascertain the fuel level. If necessary defuel the tank further (Ref. 28-25-00).

(3) When the fuel level is satisfactory, withdraw the probe far enough to note the axes of the pivot-pins and locating lug in relation to the retaining cover, to facilitate subsequent installation.

(4) Using the guide chute as a support (probes 1, 4 and 6 only) withdraw the probe as far as the electrical conduit will permit.

NOTE: The bottom ends of probes 2 and 5 will ride up the curve of the locating receptacle initially, and then hang freely.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(5) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord, and the ends of the plastic cable ties. Remove and discard the lacing cord and the cable ties.

(6) Remove the conduit securing clip.

(7) Uncoil the spare cable and withdraw the probe from the tank.

(8) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

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(9) Fit a suitable blank to the access hole, with the harness protected adequately and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(10) With the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:

(a) Note the position of the securing bolts, as one is used for electrical bonding purposes, then remove the O-ring seals and the bolts. Discard the seals.

(b) Compress the spring and remove the slider retaining ring.

(c) Gradually release the spring compression and withdraw the probe and slider assembly from the retaining cover. Remove the spring.

(d) Remove the pivot-pin retaining ring.

(e) Support the slider and withdraw the pivot-pins.

NOTE: The pins are provided with an internal UNC 3B screw thread for extraction purposes.

(f) Remove and discard the O-ring seal from the retaining cover.

D. Remove Dummy Probe 3 (Ref. Fig.404)

(1) Defuel the appropriate tank as detailed in 28-25-00, and gain access as detailed in 28-10-00.

(2) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord, and the ends of the plastic cable ties. Remove and discard the lacing cord and the cable ties.

(3) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(4) Remove the bolt securing the conduit clip and attach the electrical harness temporarily to a suitable point within the tank.

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(5) Support the probe and remove the securing bolts, then remove the probe and bolts from the tank.

(6) Temporarily replace the tank access panel.

E. Prepare to Install Probe (Ref. Fig.406)

(1) With the exception of probe 3, inspect the retaining cover and ensure that it is free from damage and corrosion, and that the paint finish is intact.

(2) Probe 1, 2, 4, 5 or 6: with the probe supported in a suitable clamp, assemble the spring cap assembly as follows:

(a) Install a new O-ring seal in its groove in the retaining cover.

(b) With the slider positioned correctly on the top of the probe (with the locating lugs aligned) insert the pivot-pins and install the pivot-pin retaining ring.

(c) Insert the spring in the retaining cover.

(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed in its groove.

(e) With the slider retaining ring in position, gradually release the compression of the spring.

(3) Dummy probe 3: check that the mounting bracket is free from cracks or corrosion, the mounting face is undamaged, and the anchor nuts are secure.

(4) Inspect the electrical cables and terminations, and repair as necessary in accordance with Wiring Diagram Manual, 20-42-49.

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F. Install probes 1, 2, 4, 5 or 6 (Ref. Fig.401, 402 and 403) (Ref. Fig.405)

(1) Comply with the fuel and electrical safety precautions.

(2) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(3) Pass the probe partly into the tank and secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.312 in (8.0 mm) of conduit protrudes beyond the clip (to ensure the security of the conduit).

(4) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.17 in (30.0 mm) for probes 1 and 5, 1.95 in (50.0 mm) for probe 2, and 1.56 in (40.0 mm) for probes 4 and 6 (nominal values). In each instance secure the coil with a length of lacing cord and a plastic cable tie. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and a reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(5) Refer to paragraph (4) and secure the remaining cable to the probe with cable ties and lacing cord as appropriate.

NOTE: To complete the installation satisfactorily, each probe must be positioned correctly in the tank in relation to its guide chute (probes 1, 4 and 6) or receptacle (probes 2 and 5) and the retaining cover.

(6) Refer to paragraph C.(2) and the preceding NOTE, then rotate the probe (1, 4 or 6) as necessary in the retaining cover, until the locating lug at the top of the probe is positioned at 180 deg to the centre line of, and the pivot-pins are parallel with the guide chute. Lower probe 2 or 5 until it engages the offset bowl of the receptacle.

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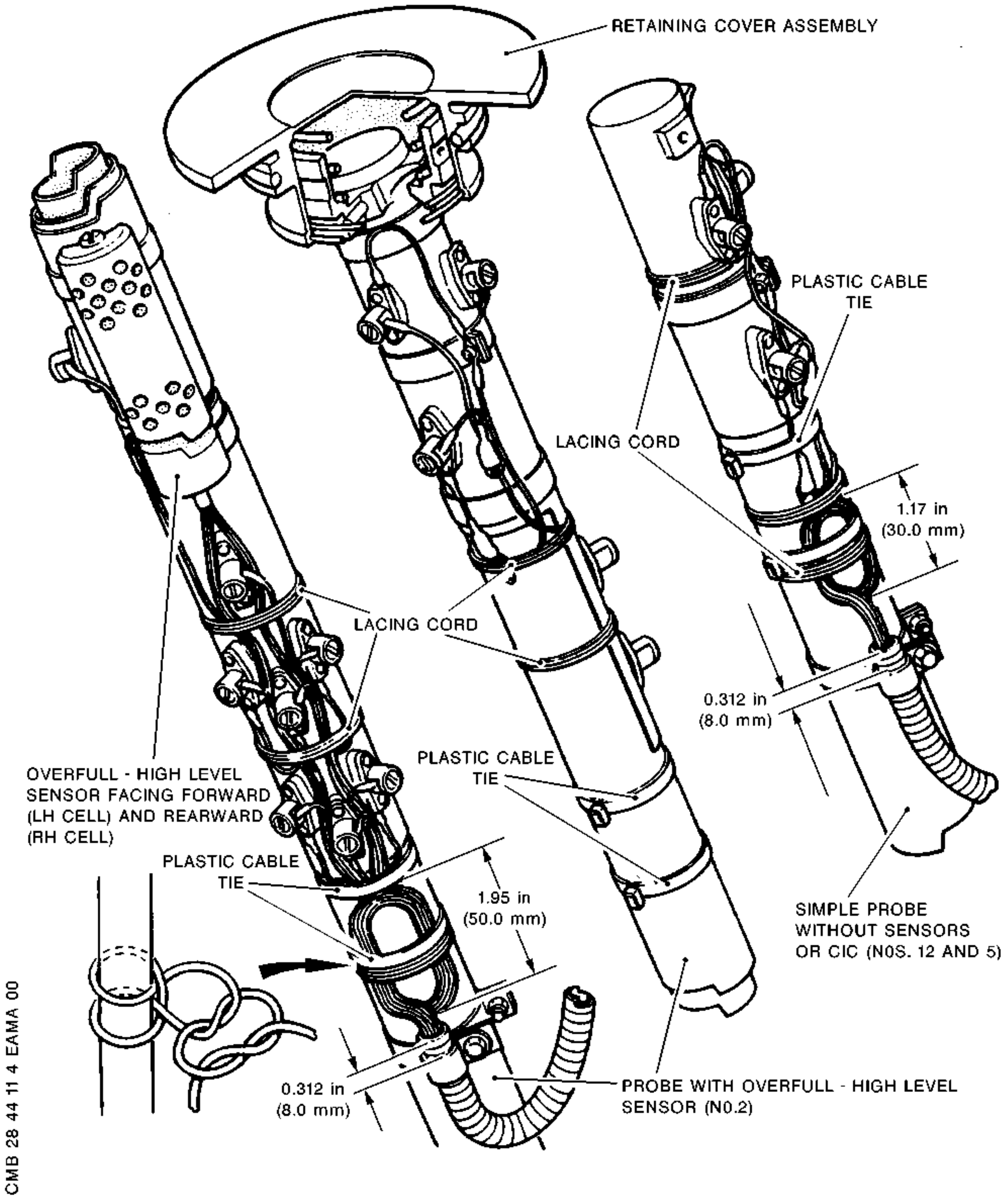

Probe Wiring Installation Details
Figure 405 (Sheet 1 of 2)

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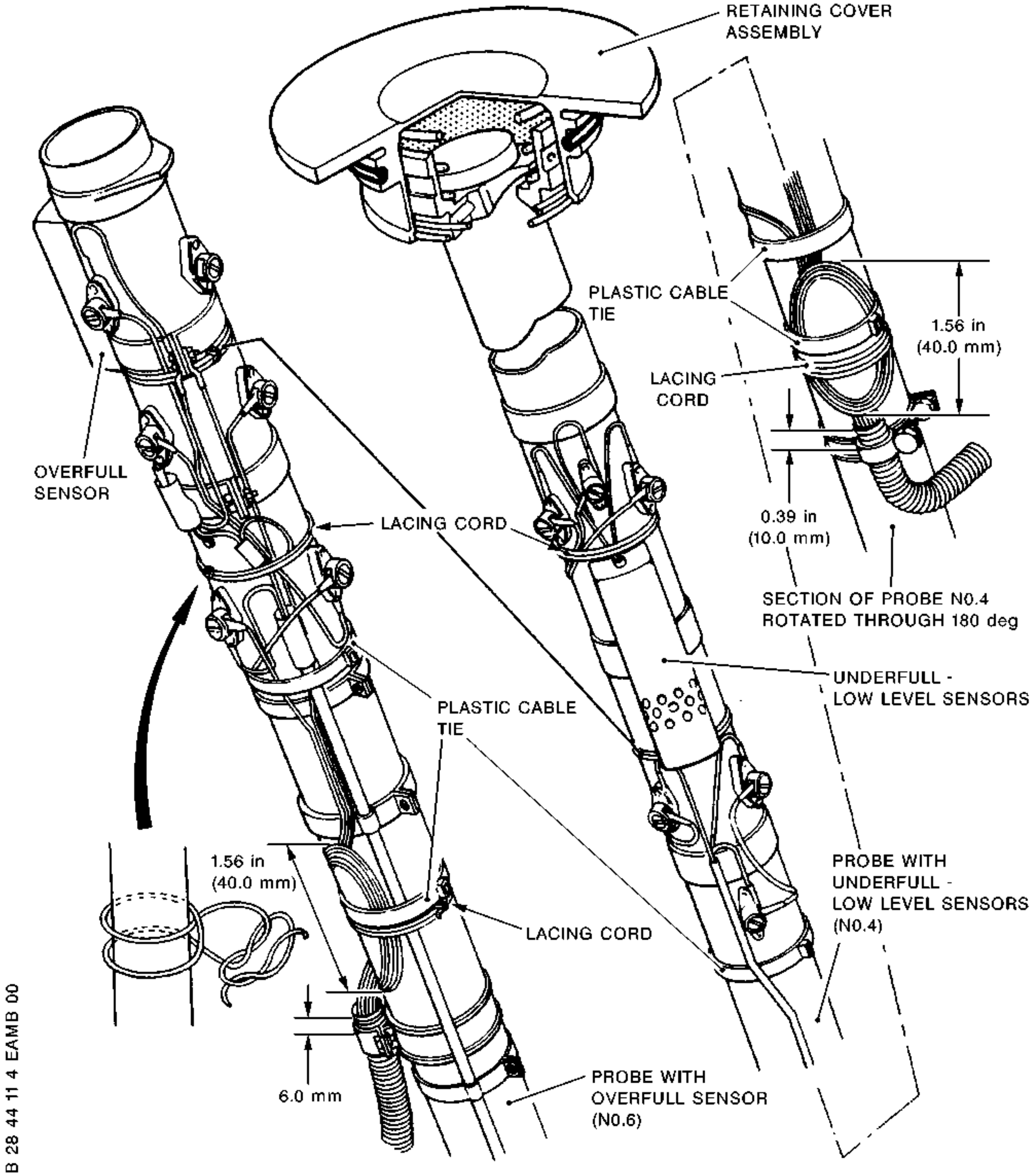
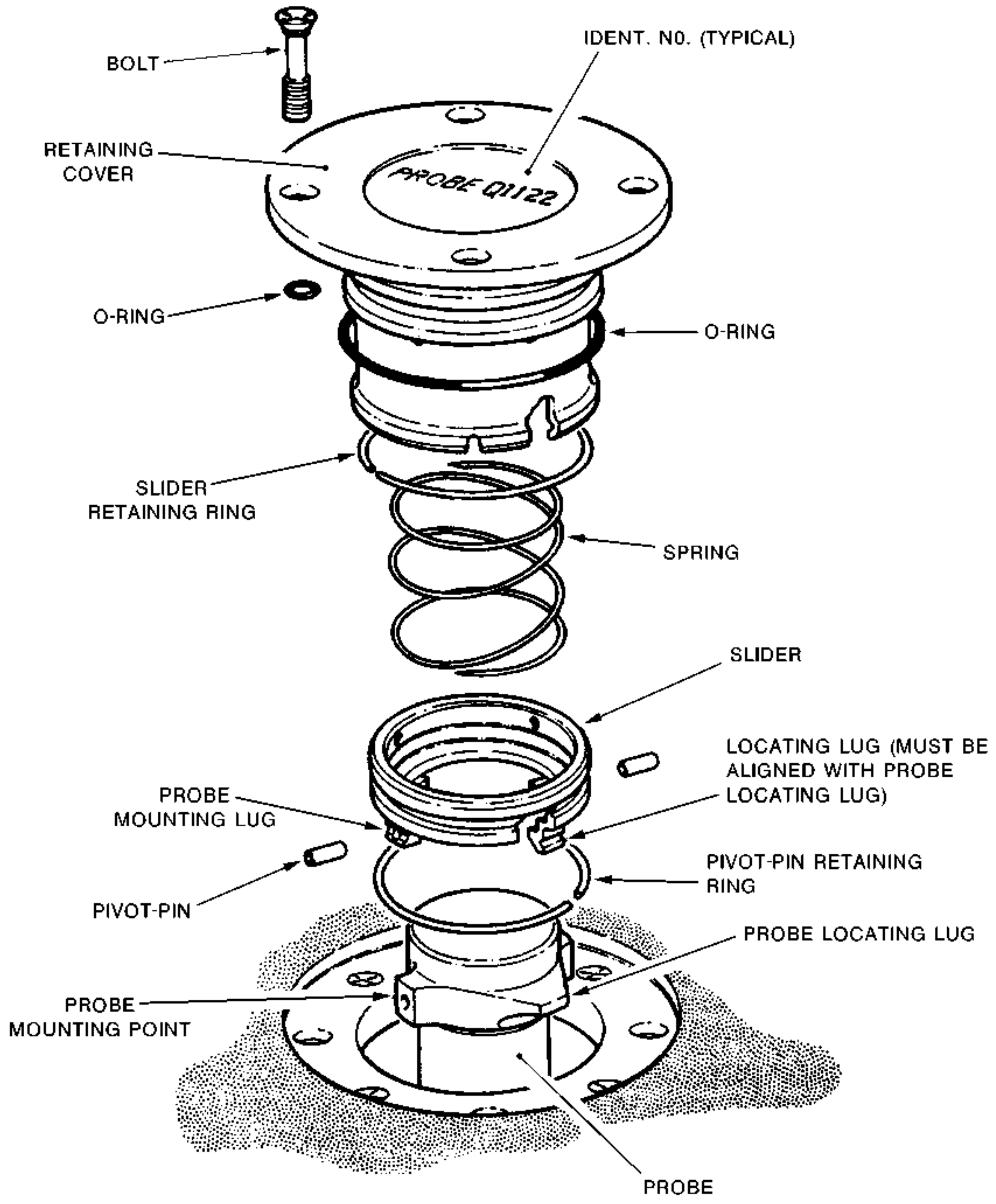


Probe Wiring Installation Details
Figure 405 (Sheet 2 of 2)



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Typical Probe Retaining Cover
Figure 406

(7) Slide the probe carefully along the guide chute (or receptacle) until the base of the probe engages the locating foot.

<u>CAUTION</u>: IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY POSITIONED IN LOCATING FOOT, THEN VISUALLY VERIFY BY EITHER REMOVING AN ADJACENT FUEL TANK ACCESS PANEL OR DEFUELLING AND ENTERING THE APPROPRIATE FUEL TANK (REF. MM 28-25-00). FAILURE TO LOCATE PROBES CORRECTLY CAN RESULT IN STRUCTURAL DAMAGE TO FUEL TANK WALLS.

(8) Rotate the retaining cover, if necessary, until, when pressed down by hand against the spring, it seats flat into the recess in the wing.

(9) Install the bolts in their correct predetermined locations in the retaining cover, complete with O-ring seals. Lubricate the seals and the retaining cover seal with clean, approved system fuel.

(10) Secure the cover to the tank with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(11) If a fuel tank access panel was removed in the CAUTION preceding para. (8) proceed as follows.

(a) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

<u>NOTE</u>: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

(12) Check that the electrical bonding is in accordance with 20-27-11.

G. Install Probe 3 (Ref. Fig.404)

(1) Comply with the fuel and electrical safety precautions.

(2) Position the probe on the mounting bracket, with the dowel engaged in its locating hole.

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(3) Secure the probe with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(4) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-29. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram.

(5) Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(6) Secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.351 in (9.0 mm) of conduit protrudes beyond the clip (to ensure the security of the conduit).

(7) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.365 in (35.0 mm) (nominal). Secure the coil with a length of lacing cord and a plastic cable tie. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09.

(8) Secure the upper runs of cable with lacing cord as shown. Secure the cord with a clove hitch and a reef knot and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(9) Check that the electrical bonding is in accordance with 20-27-11.

(10) Check that the tank is free from any foreign objects (tools
R or debris etc.).

R (11) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R <u>NOTE</u>: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (12) Refit the access panel as detailed in 28-10-00.

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H. Conclusion

(1) Reset the circuit breakers tripped before probe removal.

(2) Refuel the tank (as required) as described in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(3) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test).

(4) If the removal/installation involved a probe or probes with level sensors, check the replacement probe as detailed in 28-42-00, Adjustment/Test.

(5) Remove all tools and equipment from the area. Remove the warning placard from the flight compartment.

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PROBES, TANKS 2 AND 3 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00, AND THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-10-00, SERVICING.

1. General (Ref. Fig. 401, 402 and 403) (Ref. Fig. 404)

The probe installations for collector tanks 2 and 3 are similar, and comprise four probes in each tank.

In these instructions the probes are numbered from 1 to 4, front to rear, for clarity. In addition to their fuel quantity indication function the four probes also provide fuel level indication through the medium of level sensors. Probe 1 carries an overfull sensor, probe 2 underfull, low level, high level and overfull sensors, probe 3 a low level sensor and probe 4 an overfull sensor.

Due to the length and installed angles of the probes, guide chutes are provided for installation purposes. Each guide chute terminates in a locating foot, for positive positioning of the probe. Probe 1 is angled to face inboard and slightly forward, probe 2 is angled forward and slightly inboard, probe 3 is angled forward, probe 4 inboard.

All the probes are accessible from the wing top surface, and their identification numbers are engraved on the retaining covers. Because of the wing profile it may be necessary to partially defuel a tank to effect probe removal.

R **ON A/C 001-006,

B NOTE: F.Q.I. Probe Connections

B It is imperative the tightening methods laid down in the
B Maintenance Manual are adhered to.

B Physically check the cable terminations for movement to
B ensure that it is effectively clamped.

Electrical connections to the probes are internal, but are made with the probes partly withdrawn from the tanks.

2. Probes

A. Equipment and Materials

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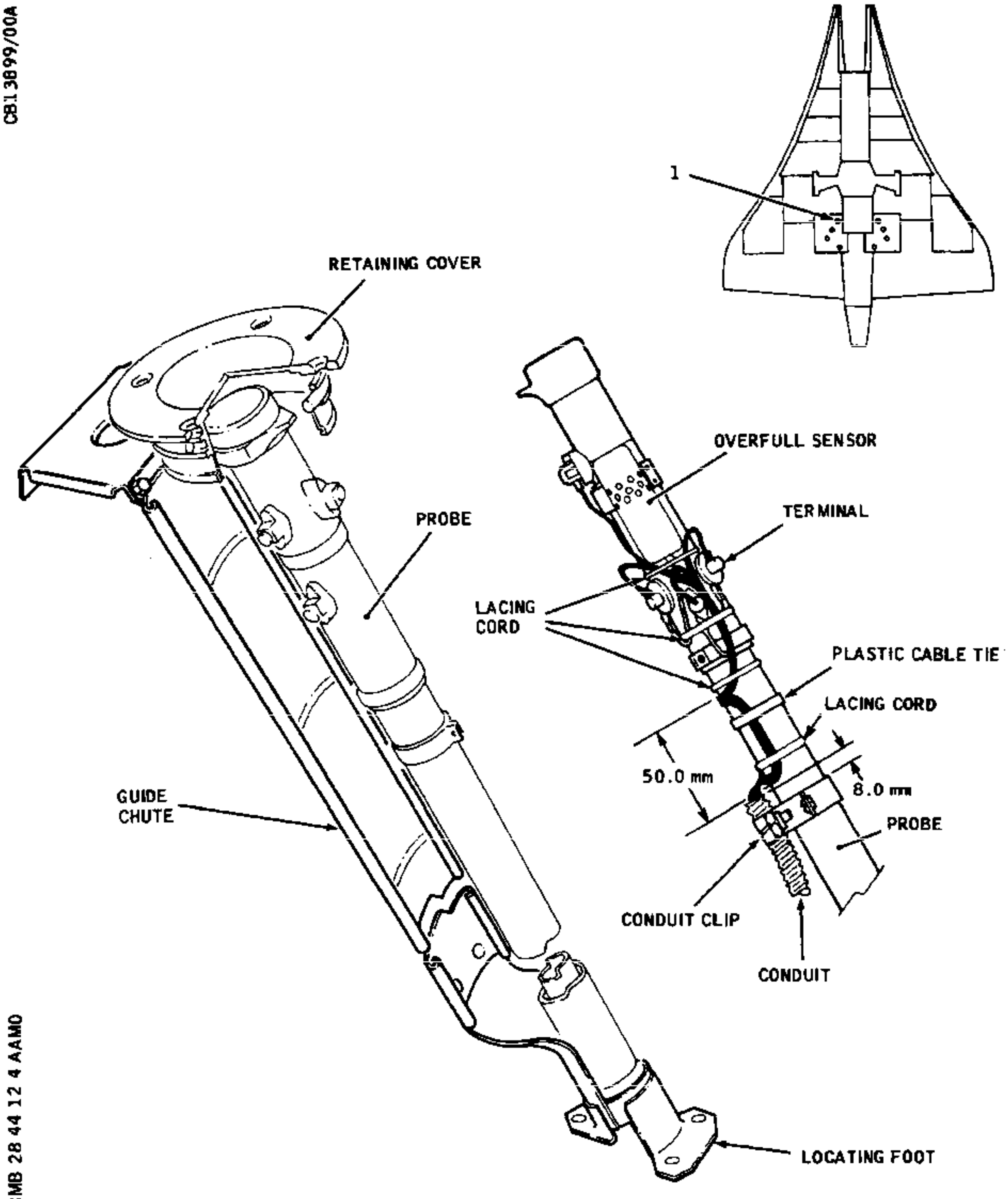

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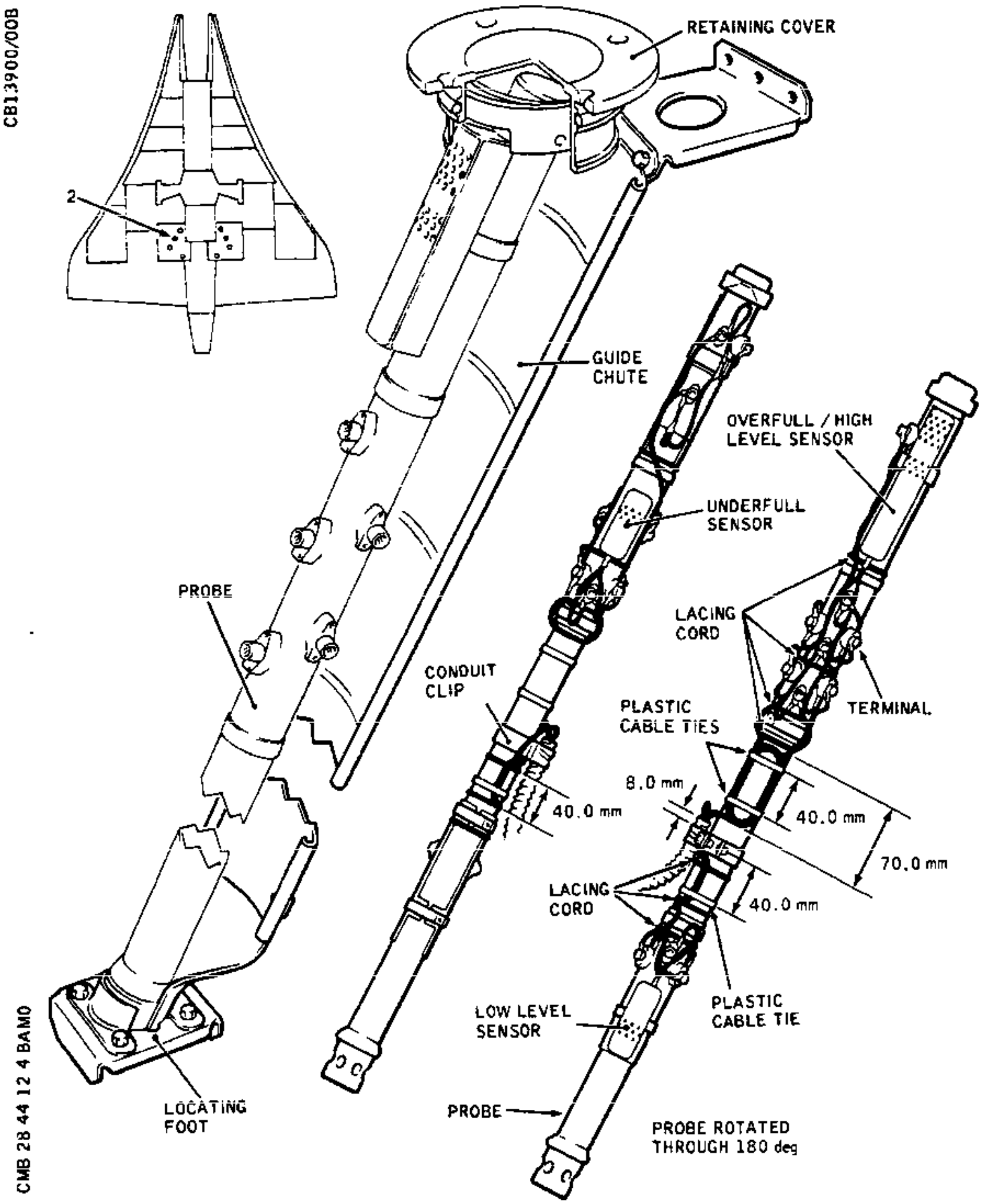
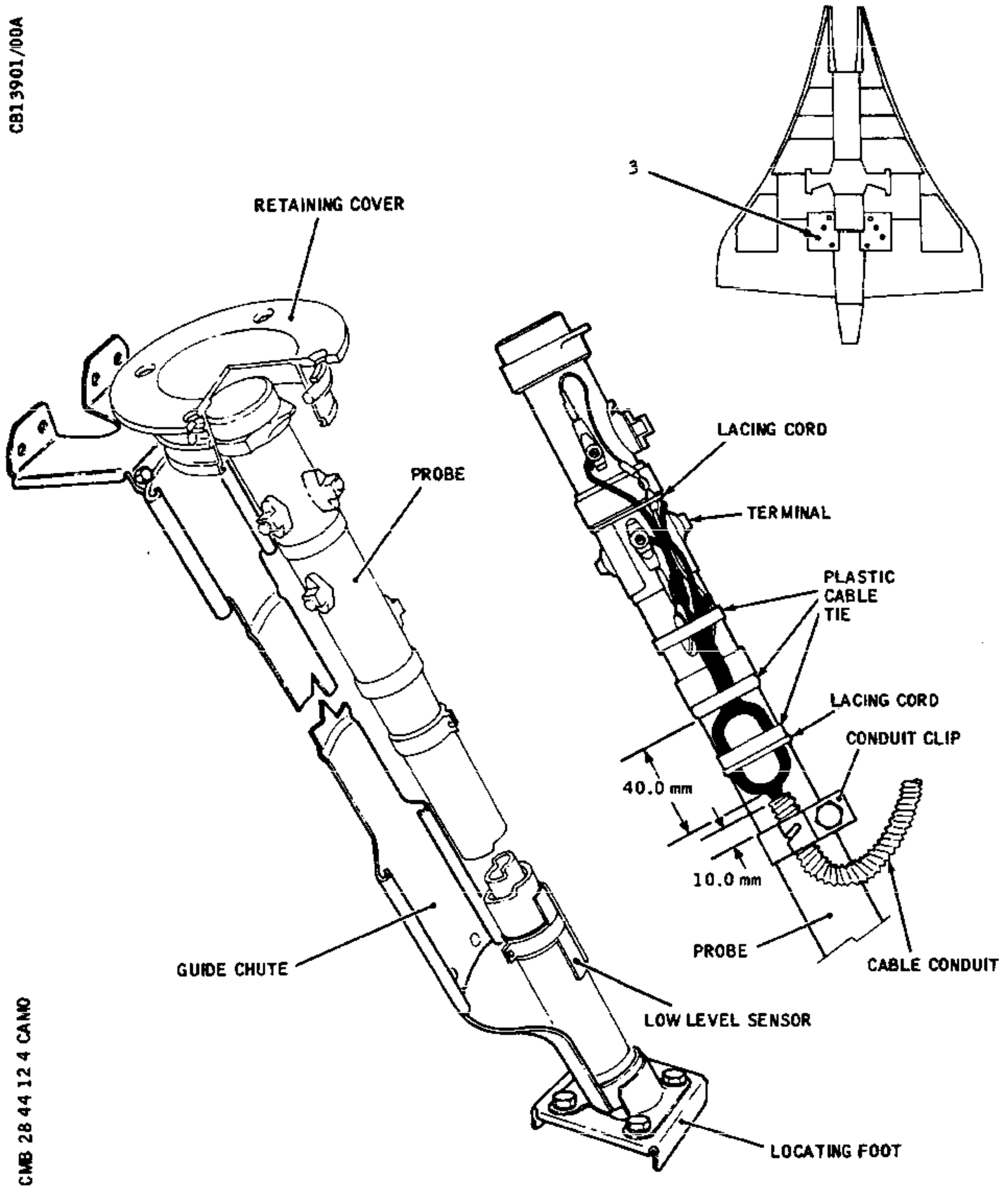
Probe 1 - Installation
Figure 401

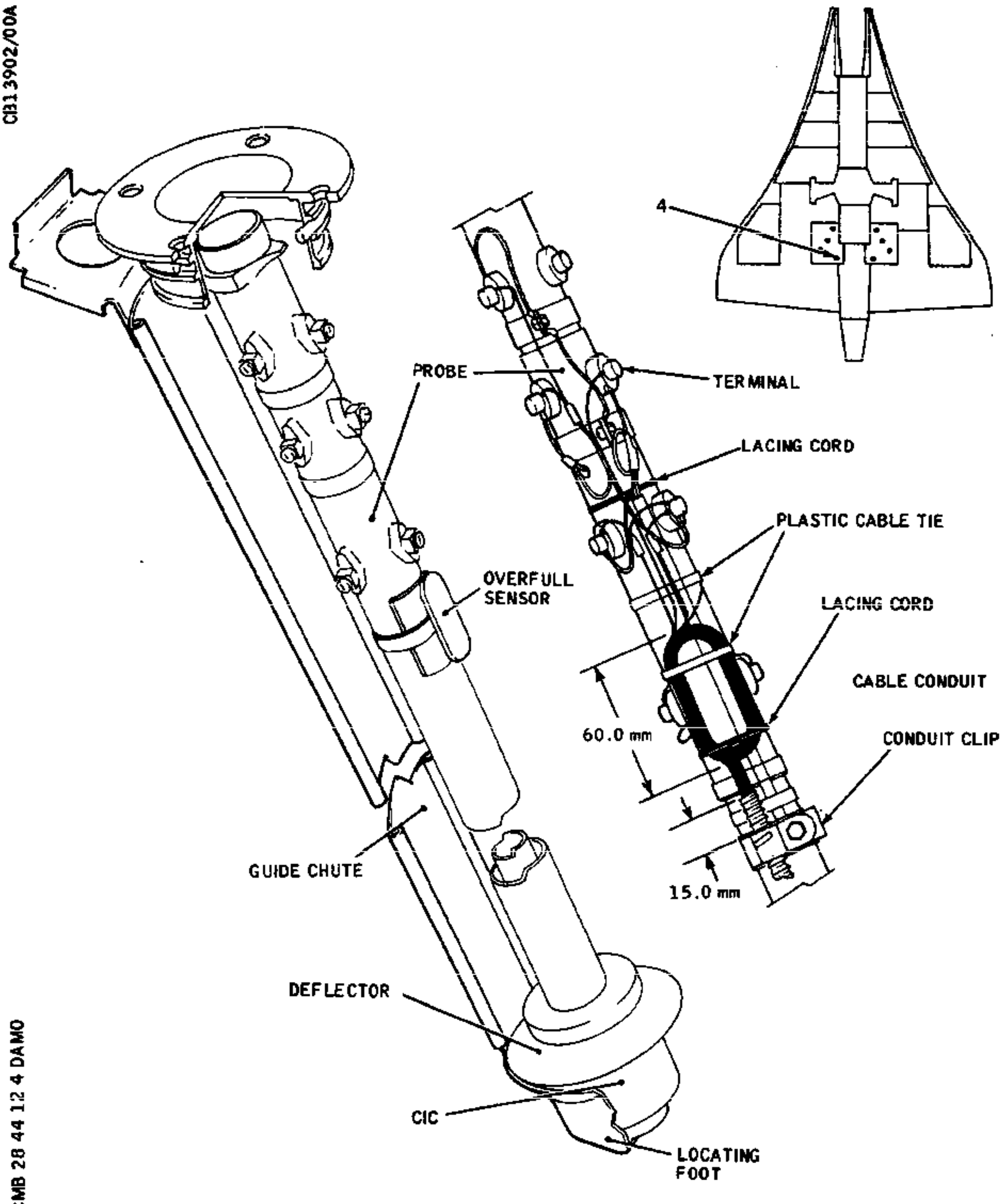


R Probe 2 - Installation
Figure 402



Probe 3 - Installation
Figure 403

CB13902/00A



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Probe 4 - Installation
Figure 404

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-

B. Prepare to Remove Probe

NOTE: If a probe is to be renewed, for other than a gauging fault, before it is removed from the aircraft an Operational Test of the associated tank FQI system must be performed (Ref. 28-40-00, Adjustment/Test).

(1) Partially defuel the appropriate tank, consistent with the probe location, as detailed in 28-25-00.

(2) Ensure that the ground refuel panel 1-194 is closed.

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switches are inadvertently operated.

(4) Isolate the electrical supplies to the probe by tripping the circuit breakers; fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected, it is suggested that all circuit breakers listed are tripped, for both tanks 2 and 3, irrespective of the probe location.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
O/FULL SUP & IND	3-213	Q1219	D5
TANKS 1 & 2 UF TANKS 3 & 4 LL SUP & IND	3-213	Q1220	D6
TANKS 3 & 4 UF TANKS 1 & 2 LL SUP & IND	1-213	Q1221	J16
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23

C. Remove Probe (Ref. Fig. 401, 402 and 403) (Ref. Fig. 404, 405 and 406)

NOTE: Due to the restricted length of the free conduit between the tank harness and the conduit clip, this removal/installation procedure may require two operators.

(1) Refer to Table 401 and identify the probe to be removed.

PROBE LOCATION	PROBE IDENT. NO. TANK 2	PROBE IDENT. NO. TANK 3
1	Q1128	Q1142
2	Q1129	Q1143
3	Q1130	Q1144
4	Q1131	Q1145

Probe Identification
Table 401

NOTE: Before a probe is removed, the position of the retaining cover, in relation to the surrounding structure, should be noted to aid installation.

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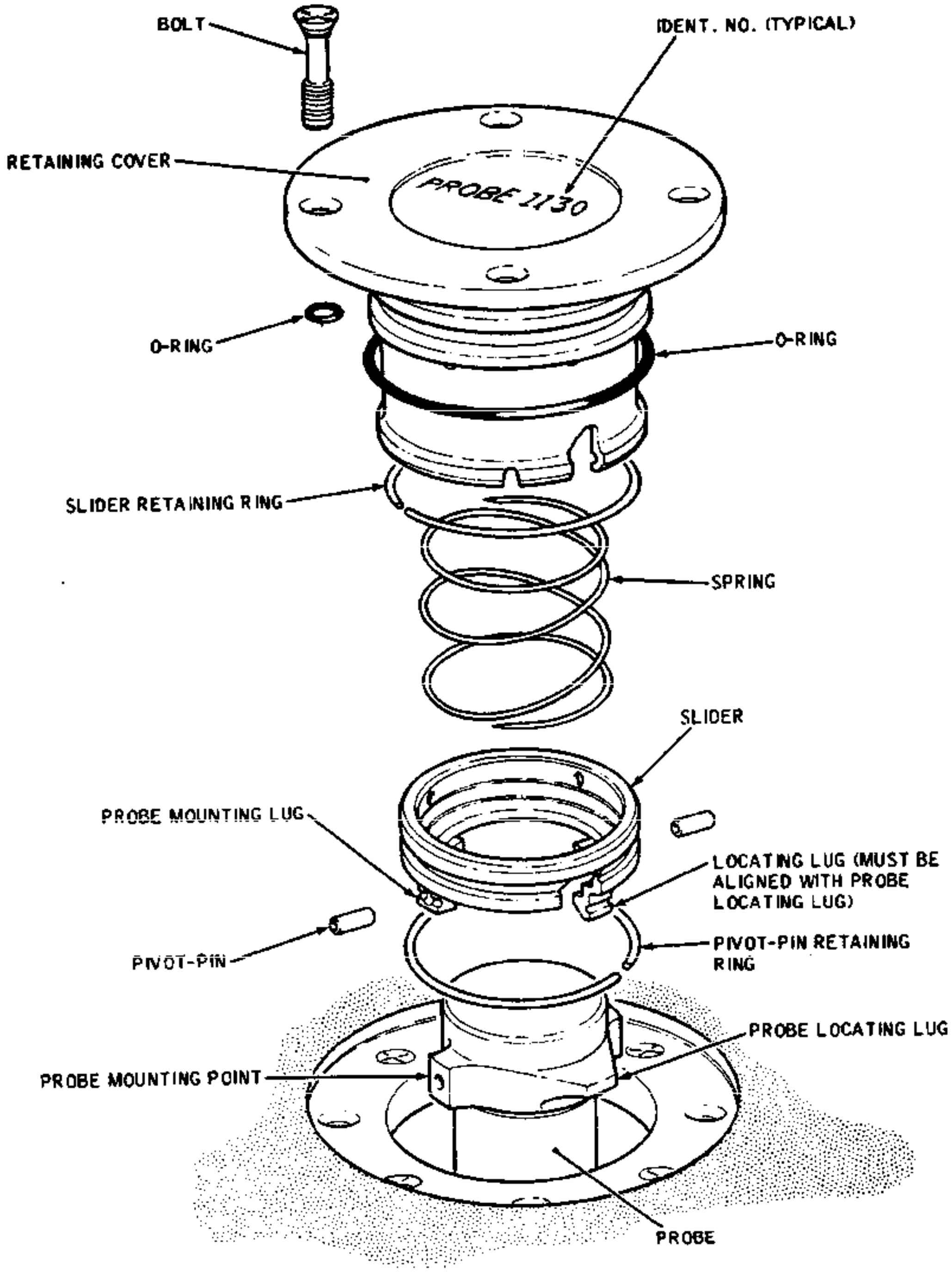

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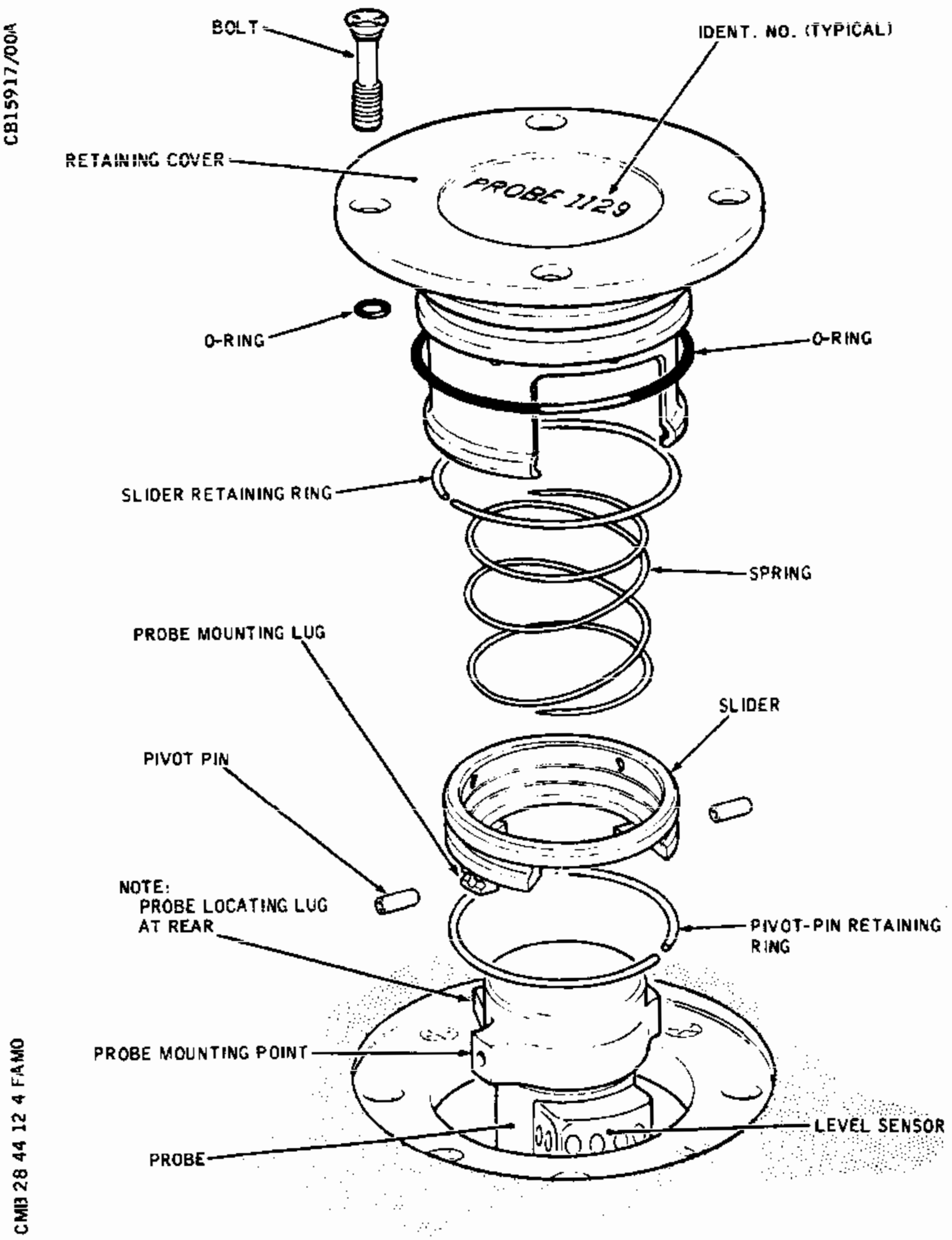
\- Retaining Cover - Probes 1, 3 and 4
R Figure 405



R Retaining Cover - Probe 2
Figure 406

(2) Unscrew the securing bolts sufficiently to disengage the threads, then ease the retaining cover, together with the bolts and O-ring seals, from the tank sufficiently to check that the fuel level is below the access hole; if necessary defuel the tank further.

(3) When the fuel level is satisfactory, withdraw the probe far enough to note the axes of the pivot pins and locating lug in relation to the retaining cover, to facilitate subsequent installation.

(4) Using the guide chute as a support, carefully withdraw the probe as far as the cable conduit will permit.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS CAN ENTER THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(5) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(6) Using end- or side-cutters, with the blades held flat against the probe, sever the knots securing the lacing cord, and the ends of the plastic cable ties; remove and discard the lacing cord and ties.

(7) Remove the conduit clip and withdraw the probe from the tank.

(8) Fit a suitable blank to the access hole, with the harness protected adequately and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(9) With the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:-

(a) Note the position of the securing bolts, as one is used for electrical bonding purposes, then remove the O-ring seals and the bolts; discard

the seals.

(b) Compress the spring and remove the slider retaining ring.

(c) Gradually release the spring compression and withdraw the probe and slider assembly from the retaining cover; remove the spring.

(d) Remove the pivot pin retaining ring.

(e) Support the slider and withdraw the pivot pins.

NOTE: The pins are provided with an internal UNC 3B screw thread for extraction purposes.

(f) Remove the O-ring seal from the retaining cover; discard the seal.

D. Prepare to Install Probe (Ref. Fig.405 and 406)

(1) Inspect the retaining cover and ensure that it is clean and free from contamination, damage and corrosion, and that the paint finish is intact.

(2) Support the probe in a suitable clamp and assemble the spring cap assembly as follows:-

(a) Install a new O-ring seal in its groove in the retaining cover.

(b) For probes 1, 3 and 4, position the slider over the top of the probe with the locating lugs aligned (Ref. Fig. 405).

(c) For probe 2, position the slider over the top of the probe with the cut-out section at 180 deg to the probe locating lug (Ref. Fig. 406).

(d) Insert the pivot pins and install the pivot-pin retaining ring.

(c) Insert the spring in the retaining cover.

(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed in its groove.

(e) With the slider retaining ring in position,

gradually release the compression of the spring.

(f) For probe 2, ensure that the cut-out section of the retaining cover coincides with the cut-out section of the slider, to accommodate the overfull/high level sensor.

(3) Inspect the electrical cables and terminations, and repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-49.

E. Install Probe (Ref. Fig. 401, 402 and 403) (Ref. Fig. 404, 405 and 406)

(1) Comply with the electrical safety precautions.

(2) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49; ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(3) Pass the probe partly into the tank and secure the conduit clip. Ensure that a nominal 8 mm of conduit protrudes beyond the clip for probes 1 and 2, 10 mm for probe 3, and 15 mm for probe 4.

(4) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of a nominal 50 mm for probe 1, 40 mm for probe 3, and 60 mm for probe 4.

<u>NOTE</u>: For probe 2 two coils of spare cable are required, the upper coil a nominal 70 mm in diameter, and the lower coil 40 mm in diameter.

(5) Secure the coils of cable to the probe with plastic cable ties, or ties and lacing cord as shown. Secure the remaining runs of cable with cable ties and lacing cord. Secure the cable ties in accordance with the Wiring Diagram Manual, 20-41-09; secure the lacing cord with a clove hitch and reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(6) For probes 1, 3 and 4, refer to paragraph C.(3) and then rotate the probe as necessary in the retaining cover, until the locating lug at the top of the probe

is positioned at 180 deg to the centre line of, and the pivot pins are parallel with, the guide chute.

(7) For probe 2, proceed as follows:-

(a) Refer to paragraph C.(3) and then rotate the probe as necessary in the retaining cover, until the locating lug at the top of the probe is facing, and the pivot pins are parallel with, the guide chute.

(b) Check that the cut-out sections of the retaining cover and slider are aligned, are facing forward, and are positioned over the top of the overfull/ high level sensor.

(8) Slide the probe carefully along the guide chute until the base of the probe engages the locating foot.

CAUTION: IF ANY UNDUE RESISTANCE IS FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY AND INVESTIGATE THE CAUSE.

(9) Rotate the retaining cover, if necessary, until when pressed down by hand against the spring, it seats flat into the recess in the wing.

(10) Install the bolts, complete with the O-ring seals, in their correct locations in the retaining cover: (Ref. NOTE preceding paragraph C.(2)).

(11) Lubricate the retaining cover O-ring seal and the securing bolt O-ring seals with clean, approved system fuel.

(12) Secure the cover to the tank with the bolts; torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(13) Check that the electrical bonding is in accordance with 20-27-11.

F. Conclusion

(1) Reset the circuit breakers tripped before probe removal.

(2) Test the probe functions for tank 2 or 3 as follows:-

(a) Perform the appropriate sections of 28-42-00,

Adjustment/Test.

(b) If the probe was renewed for other than a gauging fault, perform, in addition to the above operation (a), the appropriate sections of 28-40-00, Adjustment Test, 2. Operational Test.

(c) If the probe was renewed for a gauging fault, perform, in addition to the above operation (a), the appropriate sections of 28-40-00, Adjustment/Test, 3. Functional Test.

(3) Refuel the tank as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(4) Remove all tools and equipment from the area; remove the warning placard from the flight compartment.

PROBES, TANKS 5 AND 8 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General (Ref. Fig.401, 402 and 403) (Ref. Fig.408)

The probe installation for No.5 tank comprises five full-length probes and two dummy probes. The full-length probes are numbered 1, 2, 3, 4 and 5 in these instructions, for clarity, and the dummy probes are numbered 6 and 7. Four of the full-length probes (1, 2, 3 and 4) are simple FQI probes. No.5 is fitted with a capacitance index compensator (CIC). The two dummy probes provide mountings for Overfull and High Level sensors. No.6 embodies its own retaining cover, while No.7 is bracket-mounted within the tank.

The probe installation for No.8 tank wing cell is similar to that for No.5 tank, with the exception of the dummy probes, and the CIC on probe No.5, which are not fitted.

To aid installation a guide chute is installed in each tank at No.1 probe position (because of the acute angle of the probe) while receptacles are provided for probes 2, 3, 4 and 5. When installed the probes are held in position by locating feet and spring-loaded retaining covers.

With the exception of dummy probe 7 (installed in tank 5) all the probes are accessible from the wing top surface, and their identification numbers are engraved on the retaining covers. However, due to the wing profile it may be necessary to partially defuel the tank for probe removal. As dummy probe 7 is accessible only from within the tank, any residual fuel must be drained for removal/installation purposes.

Three probes are installed in the No.8 tank fuselage cell, which is located between, and partly forward of, No.8 tank and No.5 tank wing cells. The probes are installed in individual canisters, which aid installation, and provide locations for the upper ends of the probes, by means of spring cap assemblies. The front and rear probes, Q1118 and Q1117, are simple FQI probes. The centre probe, Q1119, provides mountings for Overfull and High Level sensors and a CIC. The front and centre probes are directly accessible from the fuselage bottom skin through the medium of retaining covers. To gain access to the rear probe, which is offset, a detachable panel must be removed, to reveal the probe retaining cover.

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Electrical connections to all the probes are internal, but with the exception of dummy probe 7, are made with the probes partially removed from the tanks.

**On A/C 001-006,

B NOTE: F.Q.I. Probe Connections

B It is imperative that the tightening methods laid down in
B the Maintenance Manual are adhered to.

B Physically check the cable terminations for movement to
B ensure that it is effectively clamped.

In the following procedures the 'Equipment and Materials', 'Prepare to Remove Probe' and 'Conclusion' paragraphs (Ref. para.A., B. and K.) are applicable to all probes. The remaining paragraphs are applicable to individual probes, or groups of probes, as indicated by the headings.

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2. Probe

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Fuel gauge probe cover extractor	D925259000

B. Prepare to Remove Probe

(1) If dummy probe 7, or a fuselage cell probe is to be removed, defuel the appropriate tank completely as detailed in 28-25-00. For the removal of the remaining probes partially defuel the tank as necessary, or transfer fuel from either tank as detailed in 28-22-00. Gain access to tank 5, if required, as detailed in 28-10-00.

(2) Ensure that the ground refuel panel 1-194 is closed.

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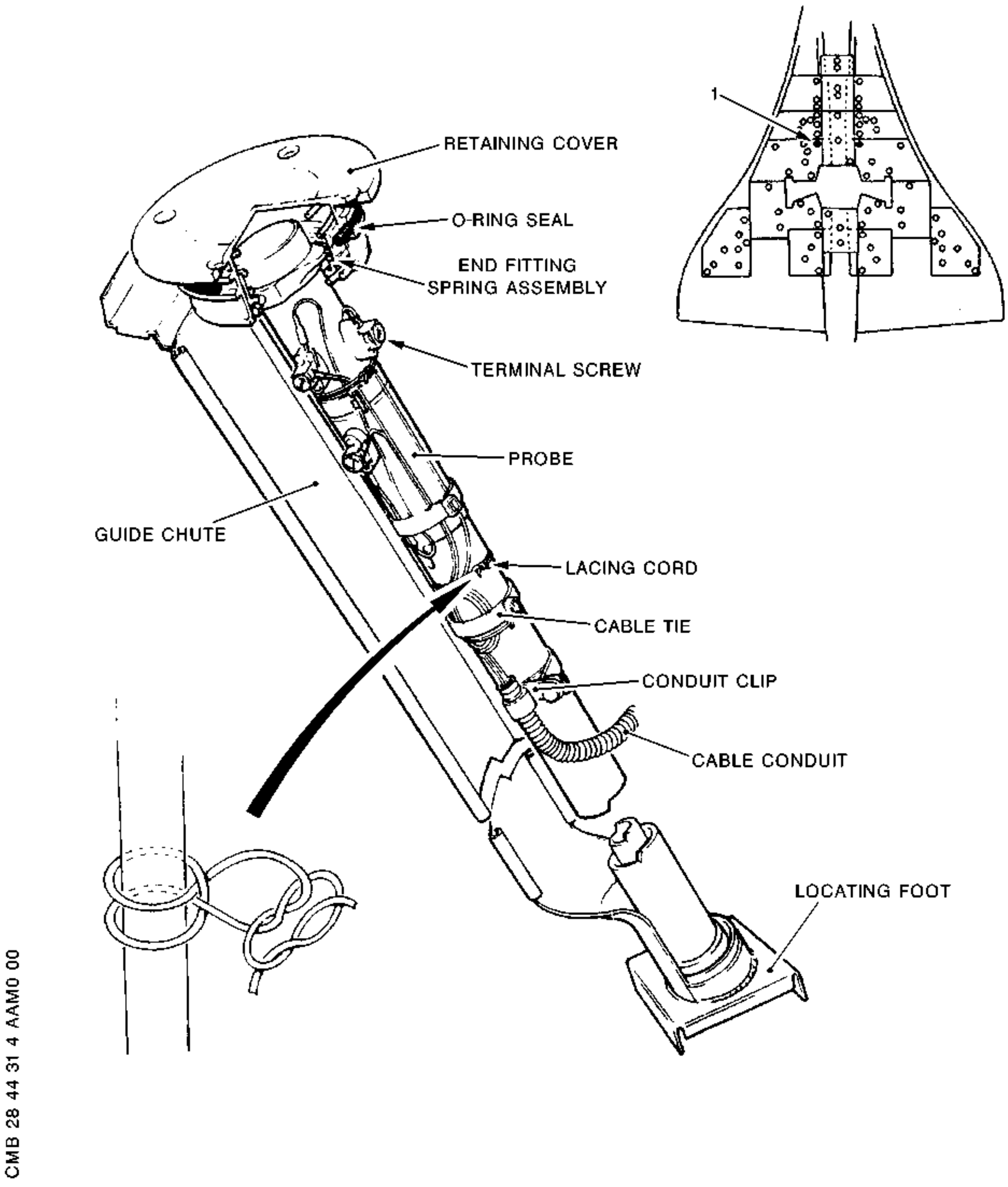
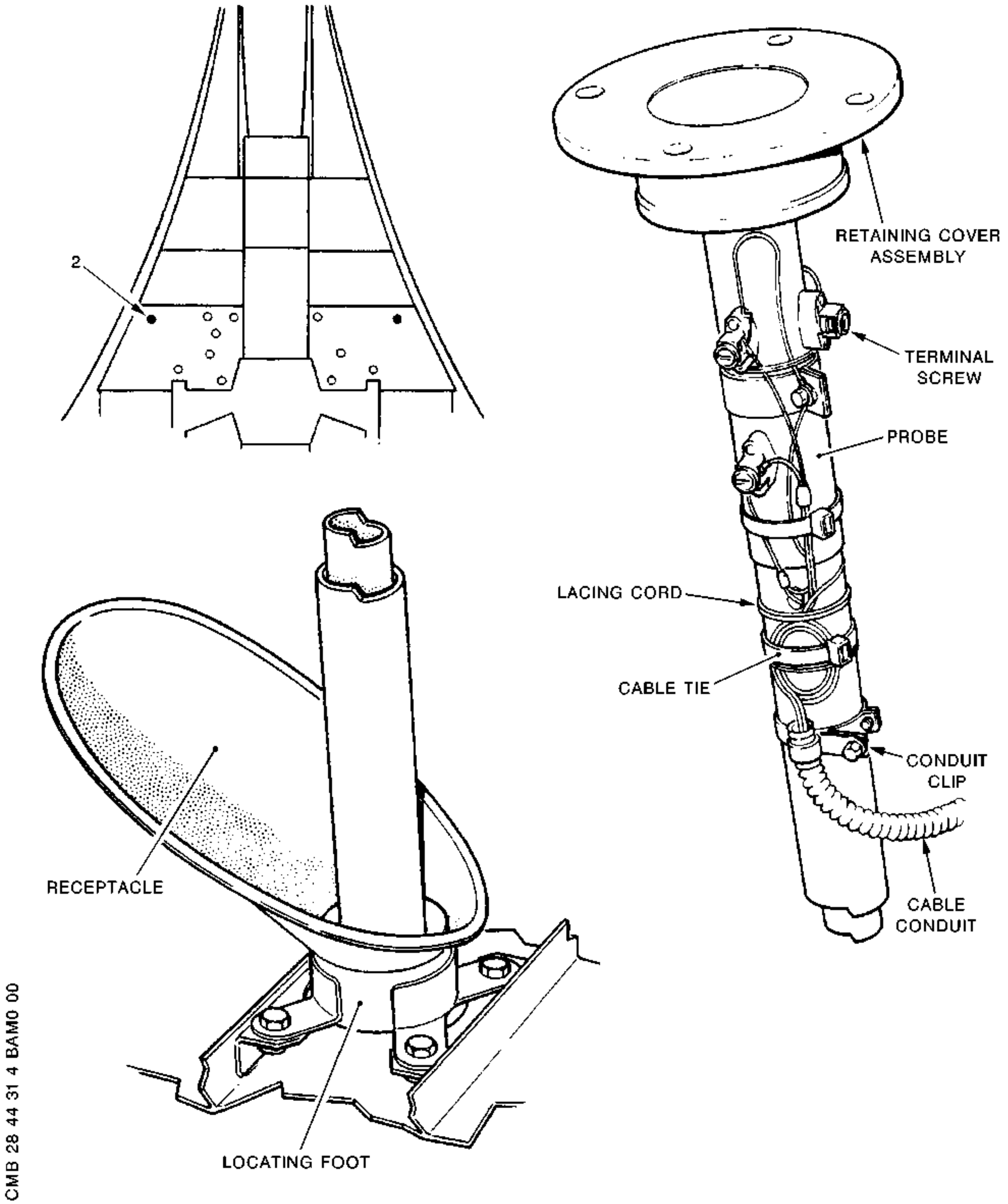


Probe 1 - Installation
Figure 401



Probe 2 - Installation
Figure 402

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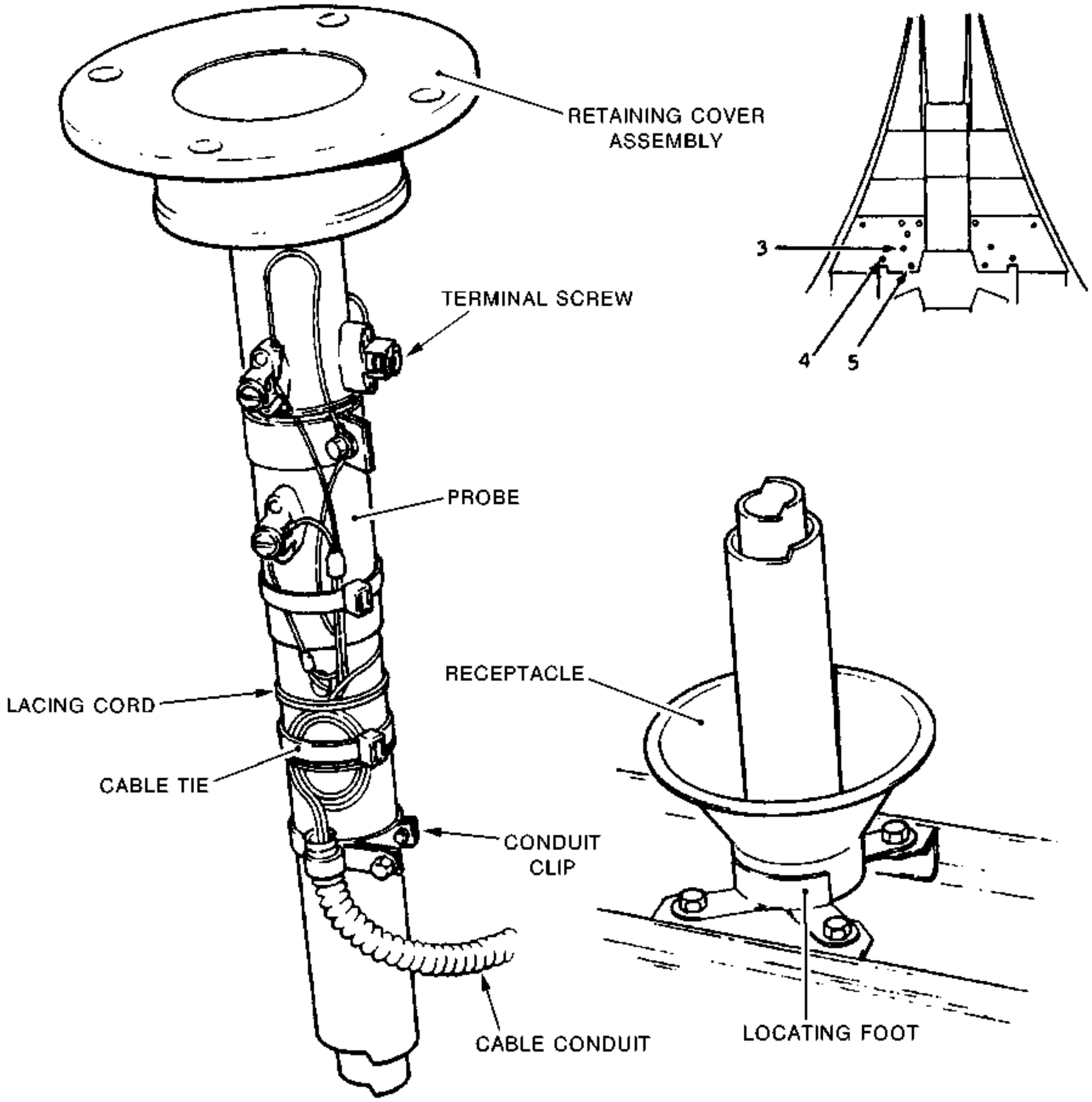

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Probes 3, 4 and 5 - Typical Installation
Figure 403

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switch is inadvertently operated.

(4) Isolate the electrical supplies to the probe by tripping the appropriate circuit breakers. Fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected, it is suggested that all circuit breakers listed are tripped, for both tanks 5 and 8, irrespective of the probe location.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F 8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D 5
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C 2
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22

C. Remove Wing Cell Probe 1, 2, 3, 4 or 5, or Dummy Probe 6 (Ref. Fig.401, 402 and 403) (Ref. Fig.404 and 406)

NOTE: Due to the restricted length of the free conduit between the tank harness and the conduit clip on the probe (all probes except dummy probe 6) two operators may be required to perform the necessary electrical disconnection operations for probe removal.

(1) Refer to Table 401 to identify the probe to be removed. The full-length probes are identified front to rear (as far as practicable) for both wing tanks. Dummy probe 6 is situated (offset) between probes 1 and 2.

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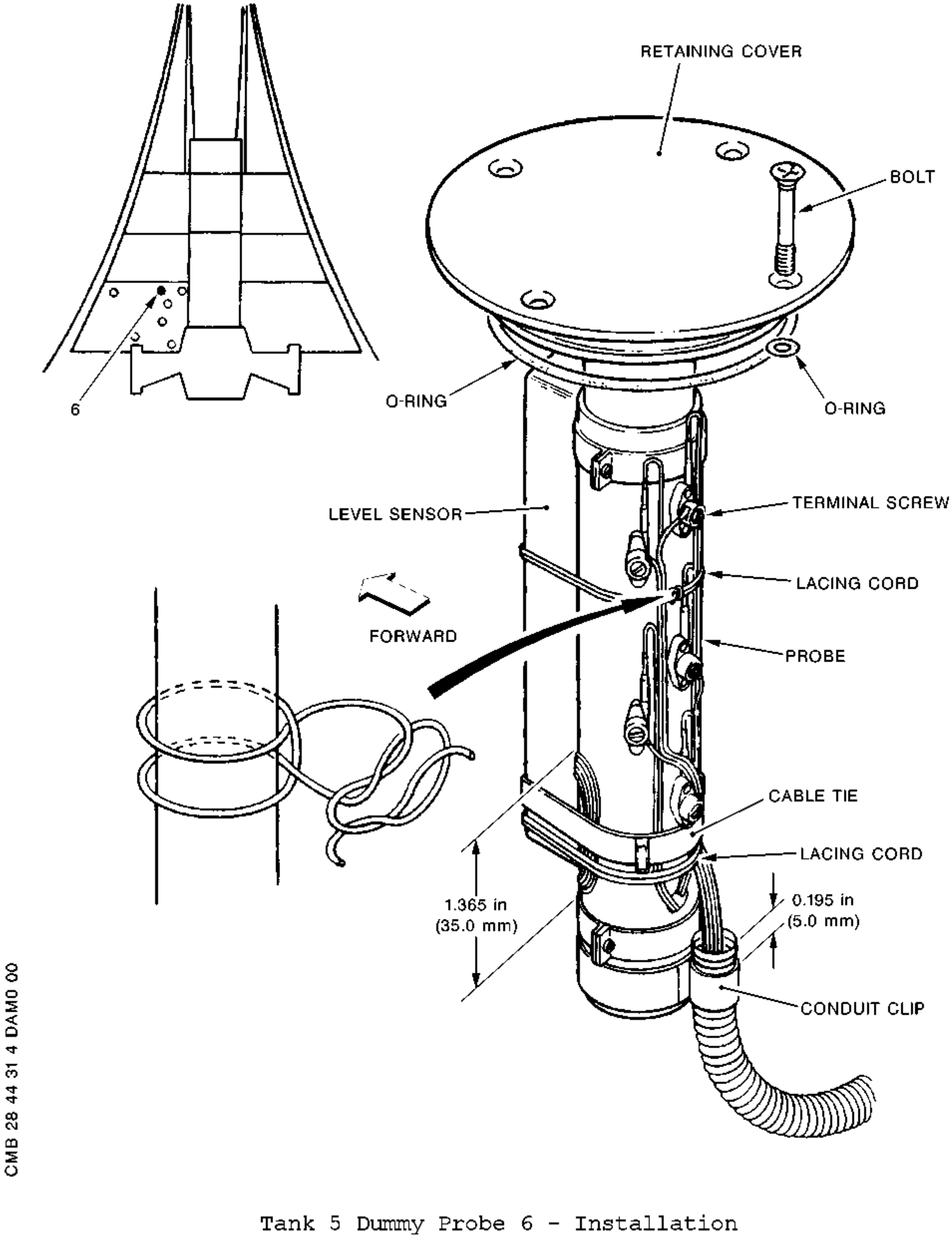

Tank 5 Dummy Probe 6 - Installation
Figure 404

PROBE LOCATION	PROBE IDENT. NO.5 TANK	PROBE IDENT. NO.8 TANK
1	Q1146	Q1112
2	Q1147	Q1113
3	Q1148	Q1114
4	Q1149	Q1115
5	Q1150	Q1116
6	Q1209	-
7	Q1335	-

Probe Identification
Table 401

NOTE: Before a probe is removed, the position of the retaining cover, in relation to the surrounding structure, should be noted to aid installation, especially for probe 6.

(2) Unscrew the securing bolts sufficiently to disengage the threads, then ease the retaining cover, together with the bolts and O-ring seals, from the tank sufficiently to check that the fuel level is below the access hole. If necessary defuel the tank further.

(3) When the fuel level is satisfactory, withdraw the probe (full-length) far enough to note the axes of the pivot-pins and locating lug in relation to the retaining cover, to facilitate subsequent installation, then withdraw the probe until the cables are accessible.

NOTE: Probe 1: the guide chute will form a support as the probe is withdrawn.

Probe 2, 3, 4 or 5: the bottom end of the probe will ride up the bowl of the receptacle initially, then the probe will hang freely.

Probe 6: may be removed completely, subject to the limitations imposed by the cable conduit.

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CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(4) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord, and the ends of the plastic cable ties. Remove and discard the lacing cord and the cable ties.

(5) Remove the conduit securing clip.

(6) Uncoil the spare cable and withdraw the probe from the tank.

(7) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(8) Fit a suitable blank to the access hole, with the harness protected adequately and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(9) Probe 1, 2, 3, 4 or 5: with the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:

(a) Note the position of the securing bolts, as one is used for electrical bonding purposes, then remove the O-ring seals, and the bolts. Discard the seals.

(b) Compress the spring and remove the slider retaining ring.

(c) Gradually release the spring compression and withdraw the probe and slider assembly from the retaining cover. Remove the spring.

(d) Remove the pivot-pin retaining ring.

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(e) Support the slider and withdraw the pivot-pins (the pins are provided with an internal UNC3B screw thread for extraction purposes).

(f) Remove and discard the O-ring seal from the retaining cover.

(10) Dummy probe 6: note the positions of the securing bolts, then remove and retain the bolts for use with the replacement probe.

D. Remove Wing Cell Dummy Probe 7 (Ref. Fig.405)

(1) Defuel the appropriate tank as detailed in 28-25-00, and gain access as detailed in 28-10-00.

(2) Remove the conduit securing clip.

(3) Disconnect the electrical cables by loosening the terminal screws and withdrawing the cable terminations.

(4) Support the probe and unscrew the securing bolts.

(5) Using end- or side-cutters, with the blades held flat against the probe, sever the knot securing the lacing cord, and the end of the plastic cable tie. Remove and discard the lacing cord and the cable tie.

<u>CAUTION</u>: ENSURE THAT ALL PIECES OF LACING CORD AND CABLE TIES ARE ACCOUNTED FOR AND REMOVED FROM THE TANK.

(6) Attach the electrical harness temporarily to a suitable point within the tank.

(7) Remove the probe complete with securing bolts from the tank, and temporarily replace the tank access panel.

E. Prepare to Install Wing Cell Probe (Ref. Fig.406)

(1) Probe 1, 2, 3, 4, 5 or 6: inspect the retaining cover and ensure that it is free from damage and corrosion, and that the paint finish is intact.

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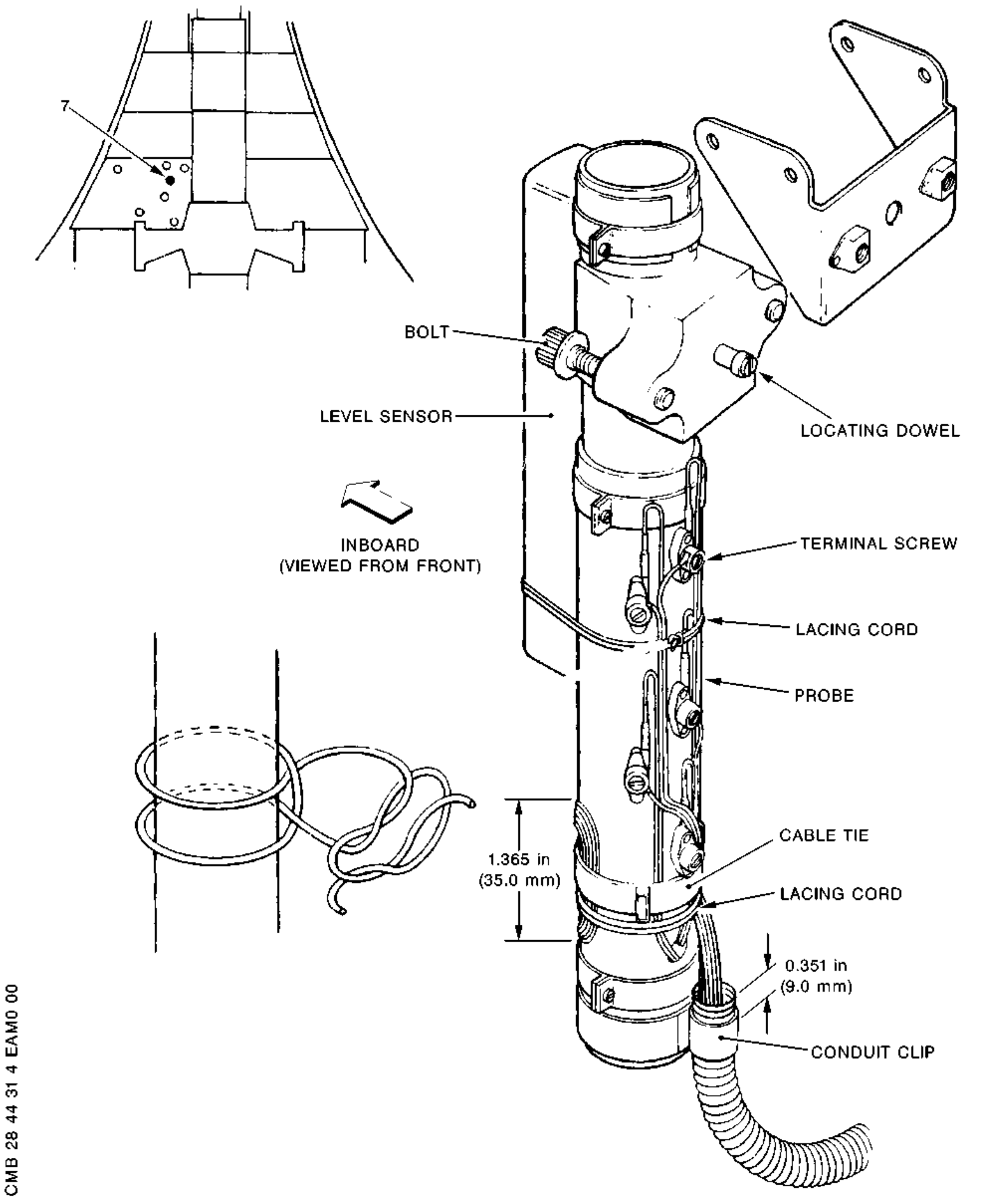
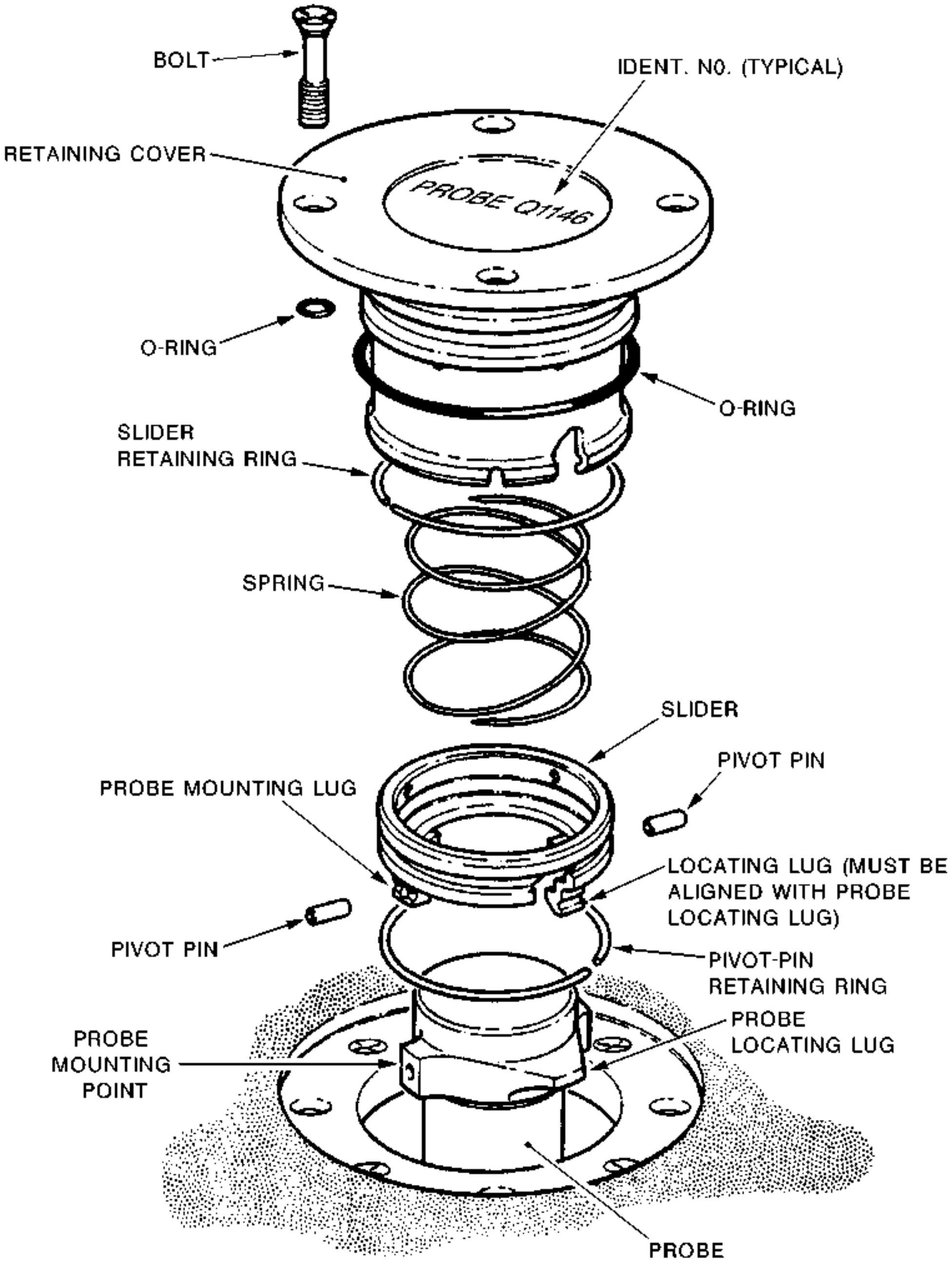


Tank 5 Dummy Probe 7 - Installation
Figure 405



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Typical Probe Retaining Cover
Figure 406

(2) Probe 1, 2, 3, 4 or 5: with the probe supported in a suitable clamp, assemble the spring cap assembly as follows:

(a) Install a new O-ring seal in its groove in the retaining cover. Lubricate the seal with clean, approved system fuel.

(b) With the slider positioned correctly on the top of the probe (with the locating lugs aligned) insert the pivot pins and install the pivot pin retaining cover.

(c) Insert the spring in the retaining cover.

(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed in its groove.

(e) With the slider retaining ring in position, gradually release the compression of the spring.

(3) Dummy probe 7: check that the mounting bracket is free from cracks or corrosion, the mounting face is undamaged, and the anchor nuts are secure.

(4) Inspect the electrical cables and terminations, and repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-49.

F. Install Wing Cell Probe 1, 2, 3, 4 or 5, or Dummy Probe 6
(Ref. Fig.401, 402 and 403)
(Ref. Fig.404, 406 and 407)

(1) Comply with the electrical and fuel safety precautions.

(2) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the screw terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(3) Probe 1, 2, 3, 4 or 5: pass the probe partly into the tank.

(4) Secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.312 in (8.0 mm) of conduit protrudes beyond the clip (0.195 in (5.0 mm), probe 6 only) to ensure the security of the conduit.

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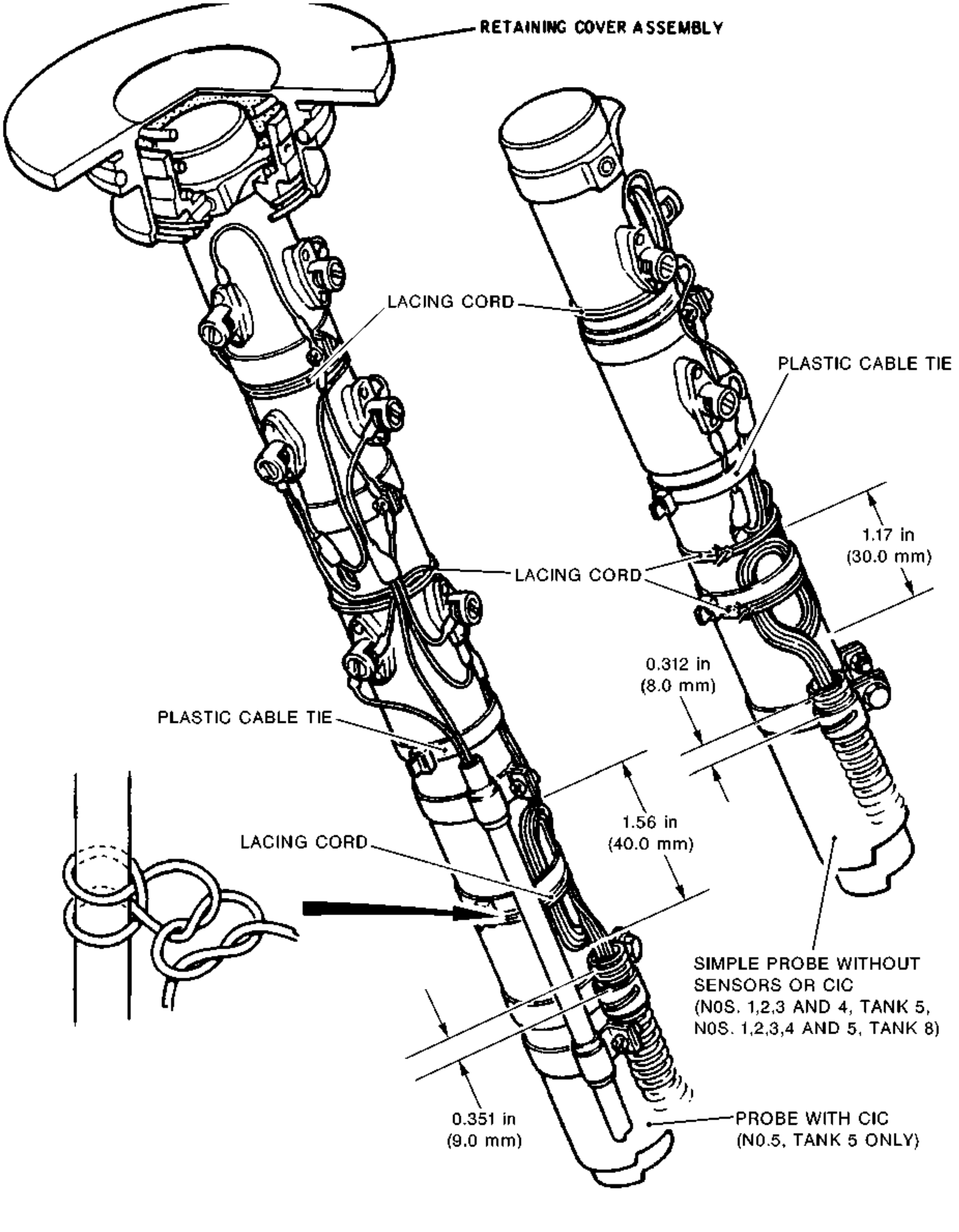

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Typical Wing Cell Probe Wiring Installation
Figure 407

(5) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.17 in (30.0 mm) for probes 1, 2, 3 and 4, 1.56 in (40.0 mm) for probe 5 and 1.365 in (35.0 mm) for dummy probe 6 (nominal values). In each instance secure the coil with a length of lacing cord and a plastic cable tie. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(6) Refer to operation (5) and secure the remaining cable to the probe with cable ties and lacing cord as appropriate.

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B CAUTION: IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
B POSITIONED IN LOCATING FOOT, THEN VISUALLY
B VERIFY BY EITHER REMOVING AN ADJACENT FUEL TANK
B ACCESS PANEL OR DEFUELLING AND ENTERING THE
B APPROPRIATE FUEL TANK (REF. 28-25-00). FAILURE
B TO LOCATE PROBES CORRECTLY CAN RESULT IN
B STRUCTURAL DAMAGE TO FUEL TANK WALLS.

NOTE: To complete the installation satisfactorily, each probe must be positioned correctly in the tank in relation to its guide chute (probe 1) or receptacle (probes 2, 3, 4 and 5) and the retaining cover, as appropriate.

(7) Probe 1, 2, 3, 4 or 5.

(a) Refer to paragraph C.(3) and the NOTE preceding paragraph C.(2).

(b) Probe 1: rotate the probe as necessary in the retaining cover, until the locating lug at the top of the probe is positioned at 180 deg to the centre line of, and the pivot-pins are parallel with, the guide chute.

(c) Probe 2, 3, 4 or 5: lower the probe until it engages the bowl of the receptacle.

(d) Slide the probe carefully along the guide chute (or receptacle) until the base of the probe engages the locating foot.

(e) Rotate the retaining cover, if necessary, until, when pressed down by hand against the spring, it seats flat into the recess in the wing.

NOTE: When the retaining cover for probe 2, 3, 4 or 5 is pressed down, if no spring resistance is felt, the probe is not located correctly in its receptacle and must be removed and re-inserted.

(8) Refer to the NOTE preceding paragraph C.(2).

(9) Refer to paragraph C.(8)(a), then install the bolts in their correct locations in the retaining cover, complete with O-ring seals. Lubricate the seals with clean, approved system fuel.

(10) Secure the cover to the tank with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(11) Check that the electrical bonding is in accordance with 20-27-11.

R (12) If it was necessary to remove a fuel tank access panel to verify the correct location in the locating foot, prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

G. Install Wing Cell Dummy Probe 7 (Ref. Fig.405)

(1) Comply with the fuel and electrical safety precautions.

(2) Position the probe on the mounting bracket, with the dowel engaged in its locating hole.

(3) Secure the probe with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

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(4) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(5) Secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.351 in (9.0 mm) of conduit protrudes beyond the clip (to ensure the security of the conduit).

(6) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.365 in (35.0 mm) (nominal). Secure the coil with a length of lacing cord and a plastic cable tie. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the upper runs of cable with lacing cord as shown. Secure the cord with a clove hitch and a reef knot, taking care not to damage the cables or insulation.

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(7) Check that the electrical bonding is in accordance with 20-27-11.

R (8) Prior to tank close-up, visually inspect all bonding leads
R to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed,
R or with braid loose in the crimp is to be replaced
R before the next flight.

R Bonding leads which show signs of surface corrosion
R only (characterized by sooty deposits or tarnishing)
R may be left installed.

R (9) Check that the tank is free from any foreign objects (tools or debris etc.) then refit the access panel as detailed in 28-10-00.

H. Remove Tank 8 Fuselage Cell Probe (Ref. Fig.408 and 409) (Ref. Fig.410)

NOTE: Access to the rear probe is gained by the removal of panel 194 MB.

(1) Identify the probe to be removed by referring to the equipment identification number engraved on the retaining cover, Q1118 front, Q1119 centre and Q1117 rear.

(2) Loosen and partially unscrew the ring of securing bolts. Keep the retaining cover pressed upward, to guard against the possibility of the pre-load spring at the opposite end of the probe forcing the probe and cover out of the tank, then remove the bolts, together with their individual O-ring seals. Note the position of the bolts, as one bolt is used for electrical bonding purposes.

(3) Ensure that the extractor neoprene facing seal is undamaged and bonded correctly, then secure the extractor to the retaining cover with the special bolts.

(4) Position a suitable container to catch any residual fuel, then, allowing for the spring force of the end fitting spring assembly, ease the cover partly from the tank. When the cover is withdrawn approximately 0.75 in (20 mm), hold the cover with the free hand and be ready to support the probe as the cover is removed completely from the tank.

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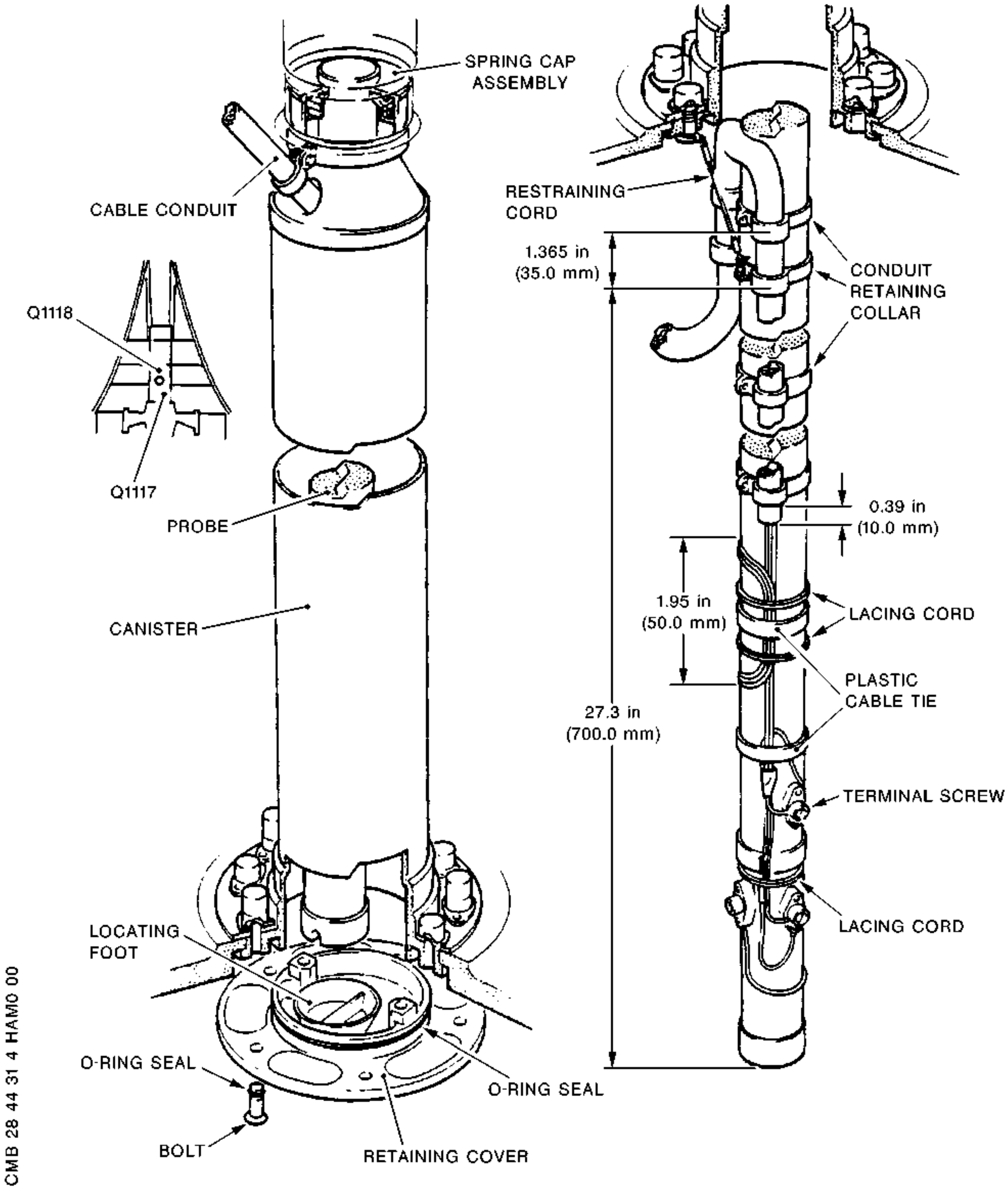
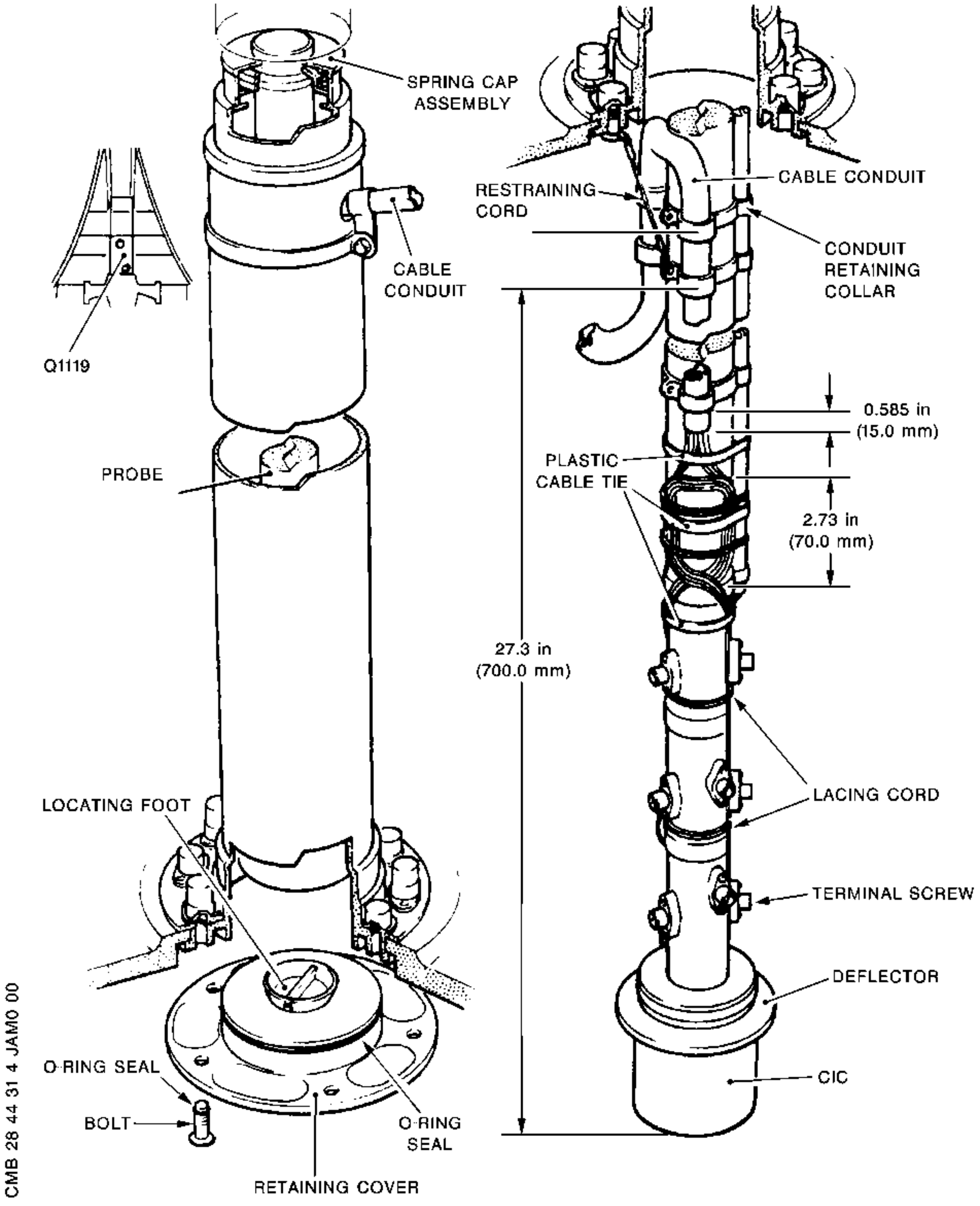


Tank 8 Fuselage Cell
Front and Rear Probes - Installation
Figure 408



Tank 8 Fuselage Cell
Centre Probe - Installation
Figure 409

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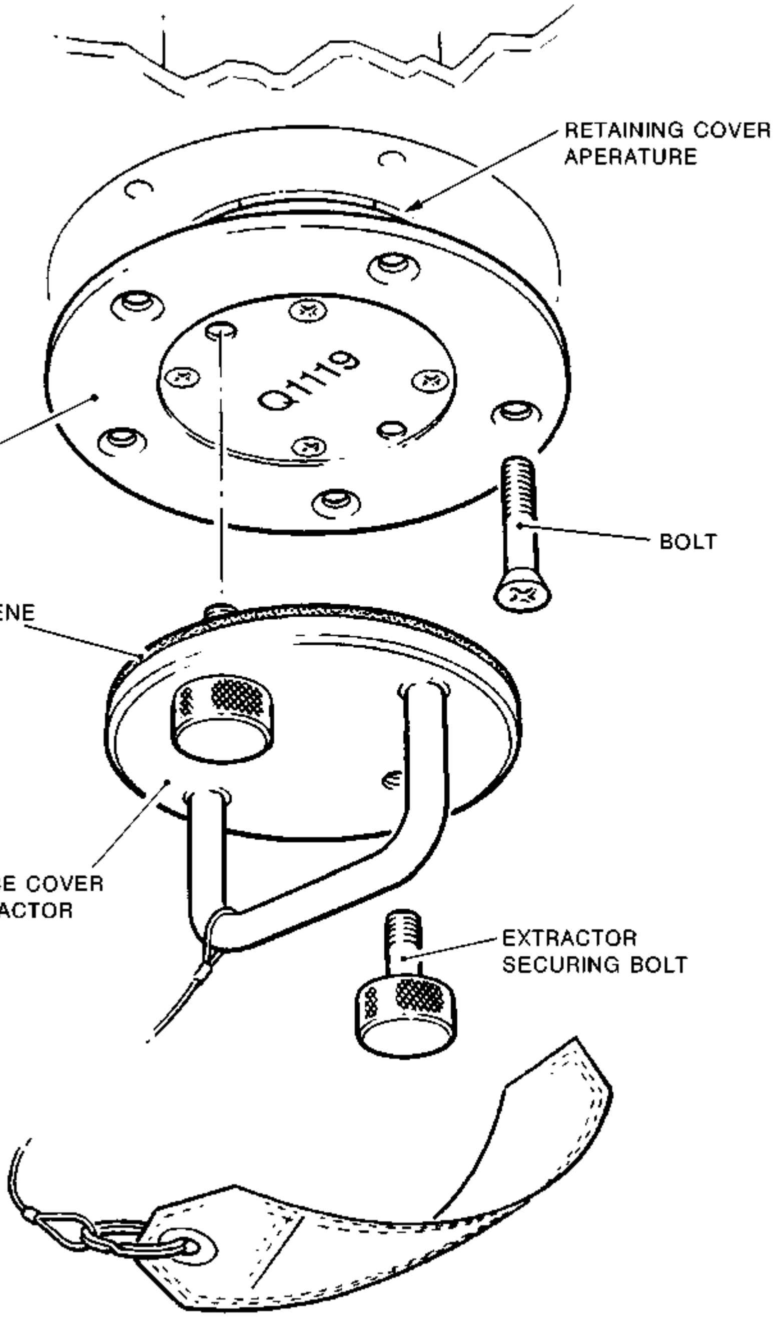

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Tank 8 Fuselage Cell, Probe Cover
Extractor - Installation
Figure 410

(5) Disengage the probe from the locating cup in the retaining cover and remove the cover.

NOTE: A cable conduit is secured to the probe by a series of retaining collars. The lower of the upper pair of collars is also used as an anchorage for a restraining cord. This restraining cord is fitted with a metal loop for attachment to the tank structure, by means of a canister securing bolt, to support the probe during the wiring and fixing collar assembly operations.

(6) Withdraw the probe carefully to reveal the upper pair of conduit fixing collars and identify the nylon restraining cord.

CAUTION: USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(7) Using end- or side-cutters, with the blades held flat against the probe, sever the knots securing the lacing cord, to free the restraining cord.

(8) Remove an adjacent bolt from the ring securing the probe canister, then use the same bolt to fasten the metal loop on the end of the restraining cord to the tank structure. If necessary, loosen the collar clamping bolt to permit the cord to position itself without kinking.

(9) Check that the probe is held securely before proceeding with the wiring disassembly.

(10) Loosen the terminal screws and withdraw the cable terminations.

(11) Refer to operation (7) and sever the remaining lacing cords, which retain the electrical cables.

(12) Sever the ends of the plastic cable ties and discard the ties.

(13) Release the collars securing the cable conduit to the probe, with the exception of the collar to which the restraining cord is attached.

(14) Support the probe and release the final collar, then carefully withdraw the probe from the tank, leaving the conduit supported by the restraining cord.

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(15) With the restraining cord still attached to the tank structure, stow the spare conduit and cable inside the canister, to prevent damage occurring.

(16) Remove the extractor from the probe retaining cover.

I. Prepare to Install Tank 8 Fuselage Cell Probe

(1) Inspect the retaining cover and ensure that it is free from damage and corrosion, and that the surface finish is intact.

(2) Install a new O-ring seal in the groove on the body of the retaining cover.

(3) Discard the existing O-ring seals on the securing bolts and install new seals. Lubricate all the O-ring seals with clean, approved system fuel. Do not change the position of the bolts as one is used for electrical bonding purposes.

(4) Inspect the electrical cables and terminations, and repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-29.

J. Install Tank 8 Fuselage Cell Probe (Ref. Fig.408 and 409)

(1) Comply with the fuel and electrical safety precautions.

(2) Pass the probe partly into the tank, then measure 27.3 in (700.00 mm) from the base of the probe and temporarily install the lower of the top pair of conduit retaining collars.

(3) Secure the collar to the probe, with the conduit routed as shown in the appropriate figure, to ensure that the cables lead to the terminals at the correct angle.

(4) Ensure that the restraining cord is securely attached to the tank and that the probe is held securely.

(5) Temporarily install the top conduit retaining collar 1.365 in (35.00 mm) above the collar installed in operation (2) and in the same configuration.

(6) Temporarily install the remaining collars as follows:

(a) Front or rear probe: measure 8.58 in (220.00 mm) from the base of the probe and install the bottom collar. Install the three remaining collars at a pitch of 4.68 in (120.00 mm).

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(b) Centre probe: measure 15.6 in (400.0 mm) from the base of the probe and install the bottom collar. Install the remaining collar 21.45 in (550.00 mm) from the base.

(7) With all the collars temporarily installed in their correct positions on the probe, check that the conduit protrudes a nominal 0.39 in (10.00 mm) (front or rear probe), or 0.585 in (15.00 mm) (centre probe), as appropriate, beyond the bottom clip. Tighten all the retaining collar securing bolts.

(8) Route the electrical cables along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(9) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.95 in (50.00 mm) (front or rear probe) or 2.73 in (70.00 mm) (centre probe) (nominal values).

(10) In each instance secure the coil with a plastic cable tie and two lengths of lacing cord as illustrated. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and a reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(11) Refer to operation (10) and secure the remaining cable to the probe with cable ties and lacing cord as appropriate.

(12) Check that the retaining cover securing bolts are positioned correctly, and that new O-ring seals are installed on them. Check that the O-ring seal is in place in its groove in the retaining cover, then lubricate all the seals with approved system fuel.

(13) Support the probe and remove the bolt used to secure the restraining cord to the tank structure. Replace the bolt and torque-tighten it to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(14) Secure the restraining cord to the probe with two lengths of lacing cord as detailed in operation (10).

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(15) Make a final check of the conduit and cable for security of attachment.

(16) Slide the probe fully home, taking care not to kink or damage the cables, and hold it in position.

CAUTION: IF UNDUE RESISTANCE IF FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY AND INVESTIGATE THE CAUSE.

(17) Position the end of the probe in the cup on the retaining cover, then ease the cover into the canister, with the probe identification number at right angles to the fuselage axis, and legible from the rear.

NOTE: To assist installation the retaining cover bolt holes are offset.

(18) Push the cover fully home and secure it with the bolts. Ensure that the earthing bolt is positioned correctly, as noted in operation (12). Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(19) Check that the electrical bonding is in accordance with 20-27-11.

K. Conclusion

(1) If the rear probe has been installed, refit access panel 194 MB.

(2) Reset the circuit breakers tripped before probe removal.

(3) Refuel the tank as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(4) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test.

(5) If a tank 5 dummy probe 6 or 7 has been changed, perform the appropriate section of the Functional Test detailed in 28-42-00, Adjustment/Test.

(6) Remove all tools and equipment from the area. Remove the warning placard from the flight compartment.

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PROBES, TANKS 5A AND 7A - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General (Ref. Fig. 401, 402 and 403)
(Ref. Fig. 404)

The probe installations for the wing transfer tanks 5A and 7A are similar, and comprise eight probes for each tank.

The probes, which in these instructions are numbered from 1 to 8 for clarity, consist of six simple FQI probes, one dummy probe with overfull and high level sensors, and a second dummy probe with a capacitance index compensator (CIC).

Because of the shallowness of the two tanks the probes are necessarily short in length, and have integral retaining covers. The covers embody cutaways to ensure that a particular probe can only be installed in its correct location in the wing. However, if necessary, a tank 5A probe may be installed in the corresponding location in tank 7A and vice versa. A bonding plate is fitted above each retaining cover and is secured by the same bolts.

All the probes are accessible from the wing top surface; their identification numbers are engraved on the retaining covers and the bonding plates. Because of the wing profile it may be necessary to partially defuel the tanks for probe removal.

**ON A/C 001-006,

RB NOTE 1: F.Q.I. Probe Connections

B It is imperative that the tightening methods laid down
B in the Maintenance Manual are adhered to.

B Physically check the cable terminations for movement
B to ensure that it is effectively clamped.

Electrical connections to the probes are internal, but are made with the probes removed from the tanks.

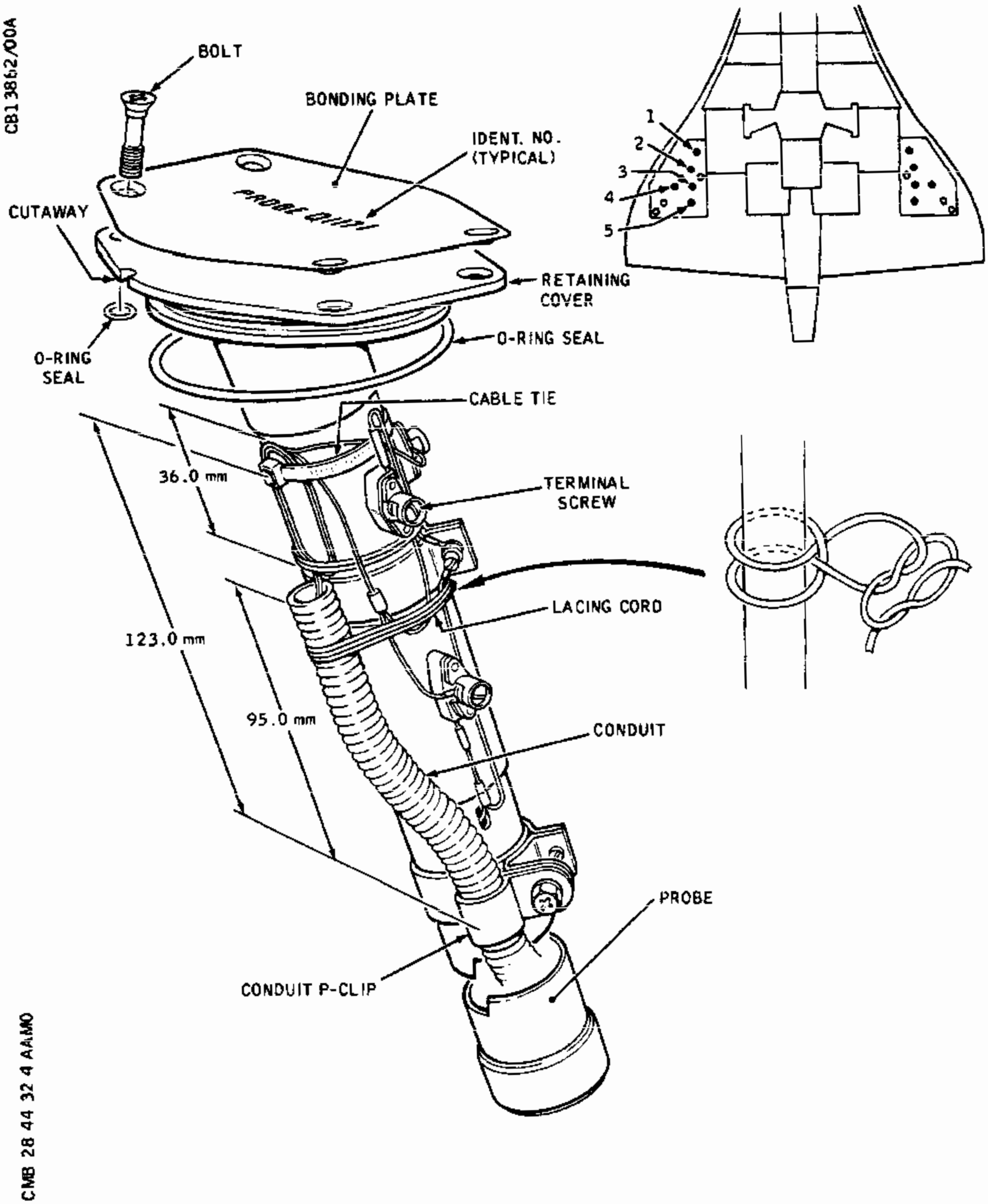
RB NOTE 2: F.Q.I. Loom Circuit Chafing

RB When access is gained to 5A or 7A. Inspect the tank
RB floor structure adjacent to Probe 6 for CONDUIT CHAFING
RB or the likelihood of it occurring. This is caused by
RB incorrectly positioned 'P' clips which can be rectified
RB by the use of washer(s) BAS 7882 or AN960-10L.
RB Ref. Figure 402 VIEW A.

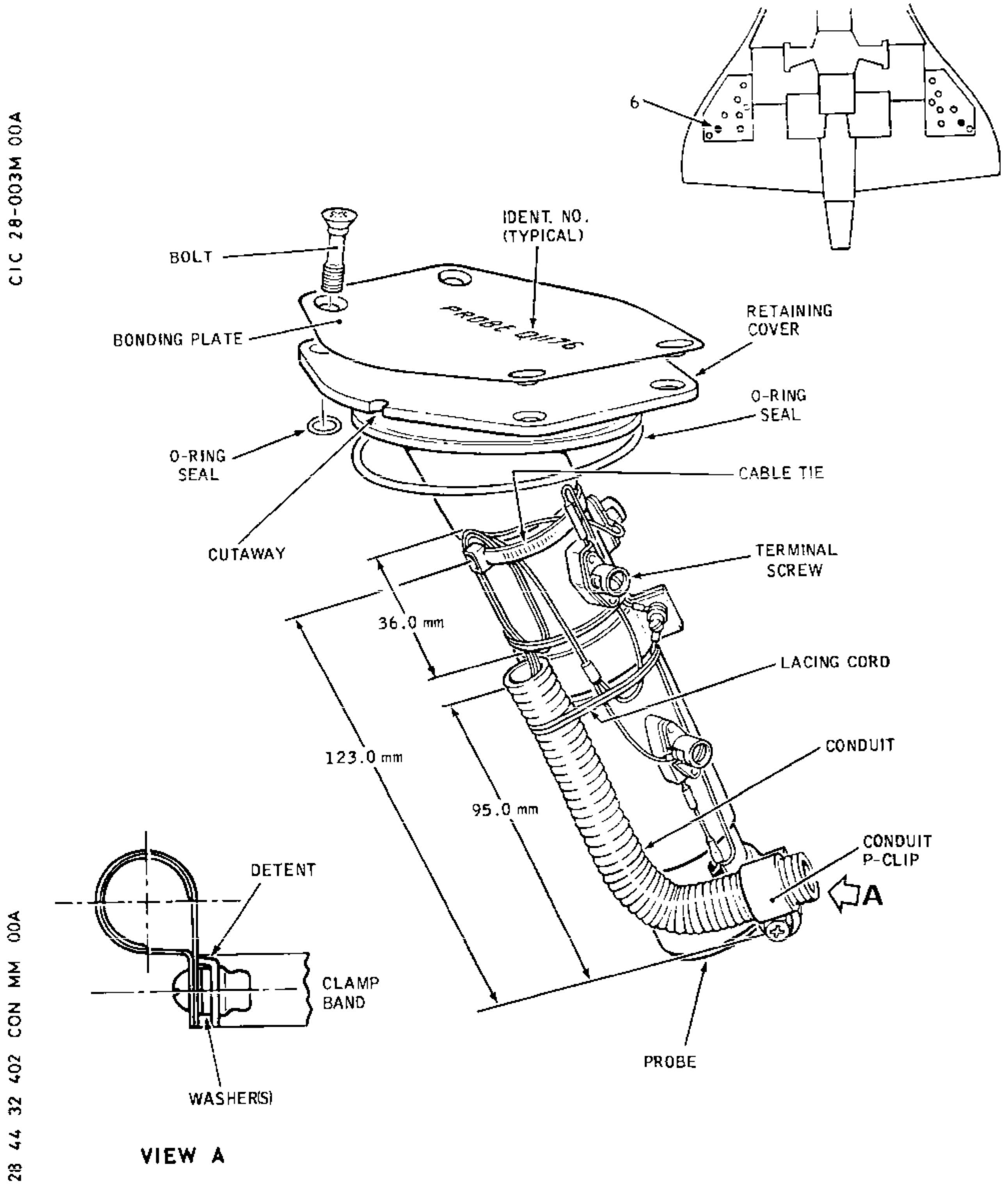
RB Any tank floor damage should be rectified in
RB accordance with the requirements of the Structure Repair
RB Manual 57-30-00 Figure 301.

2. Probes

A. Equipment and Materials

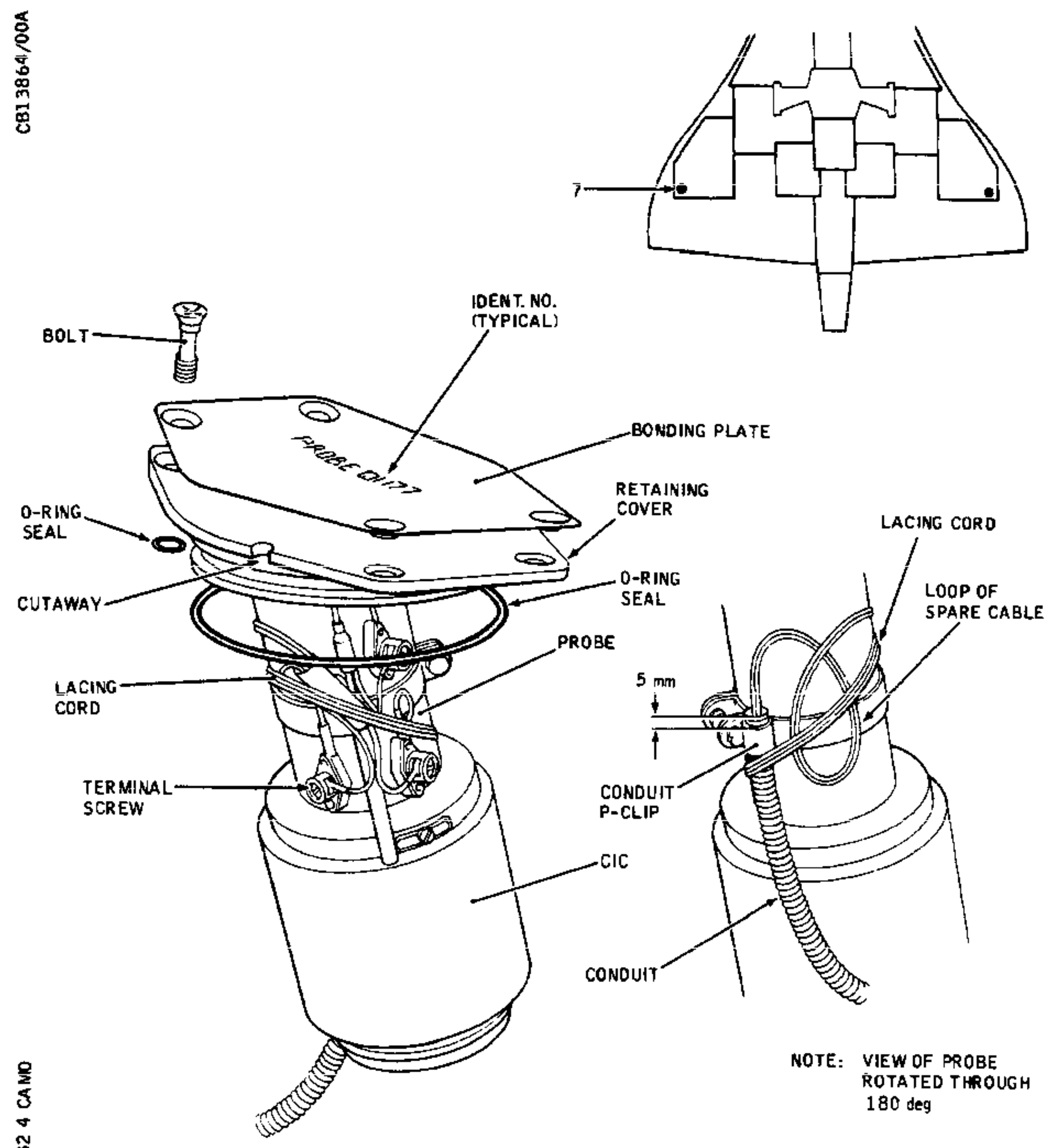


- Probes 1, 2, 3, 4 and 5 - Typical Installation
Figure 401

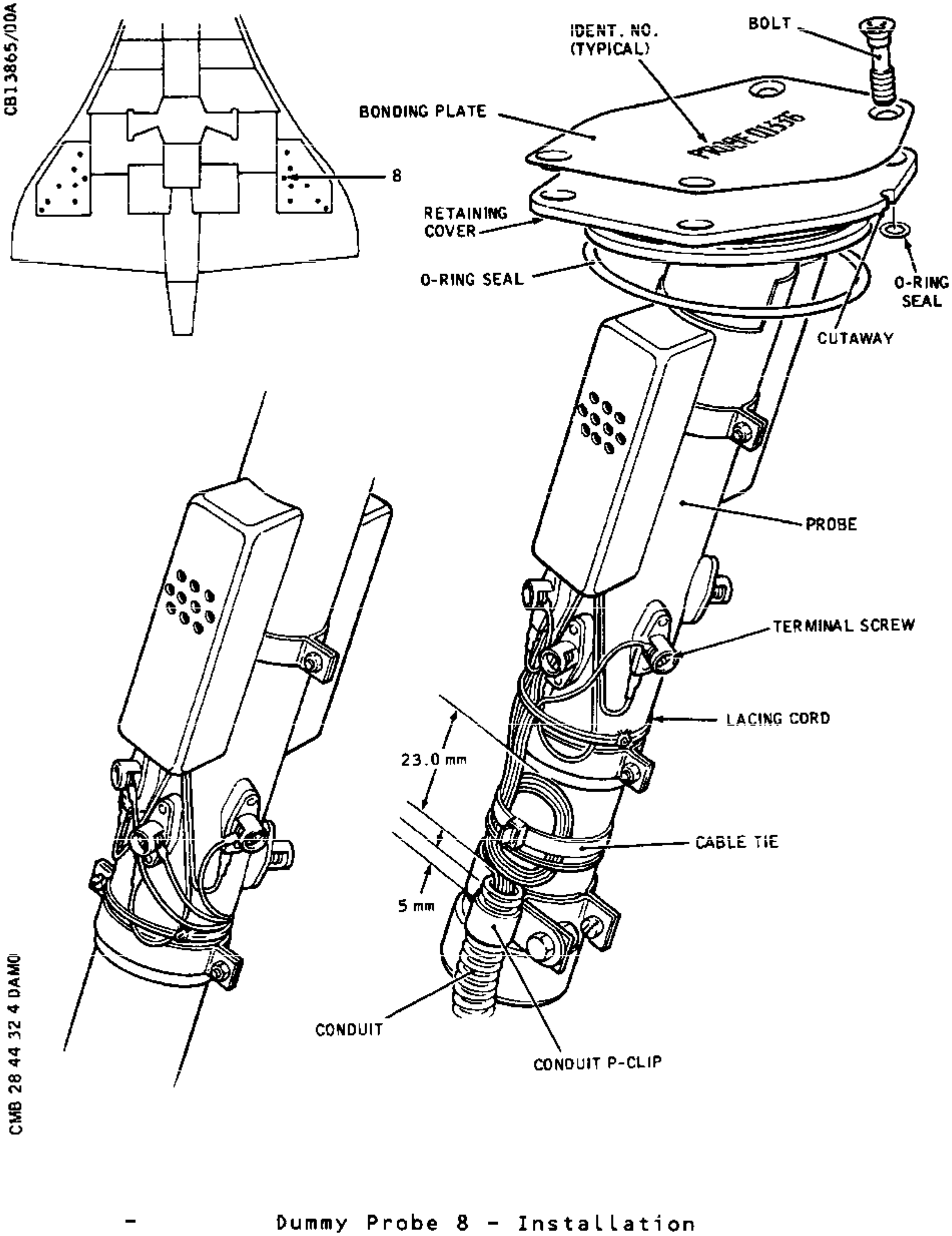


Probe 6 - Installation
Figure 402

B



Dummy Probe 7 - Installation
Figure 403



Dummy Probe 8 - Installation
Figure 404

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-

B. Prepare to Remove Probe

(1) Partially empty the appropriate tank 5A or 7A, consistent with the probe location, by transferring fuel from the tank as detailed in 28-22-00.

(2) Ensure that the ground refuel panel 1-194 is closed.

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switch is inadvertently operated.

(4) Isolate the electrical supplies to the probe by tripping the circuit breakers; fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected, it is suggested that all circuit breakers listed are tripped, for both tanks 5A and 7A, irrespective of the probe location.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D5
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22

C. Remove Probe (Ref. Fig. 401, 402 and 403) (Ref. Fig. 404)

(1) Refer to Table 401 to identify the probe to be removed; apart from the dummy probe (8), the probes are numbered from front to rear.

PROBE	PROBE IDENT. NO. TANK 5A	PROBE IDENT. NO. TANK 7A
1	Q1171	Q1178
2	Q1172	Q1179
3	Q1173	Q1180
4	Q1174	Q1181
5	Q1175	Q1182
6	Q1176	Q1183
7	Q1177	Q1184
8	Q1336	Q1338

Probe Location
Table 401

(2) Unscrew the securing bolts sufficiently to clear the threads, then ease the retaining cover, together with the bonding plate, bolts and O-ring seals, far enough from the tank to check that the fuel level is below the access hole; if necessary defuel the tank further.

(3) When the fuel level is satisfactory, withdraw the probe as far as the cable conduit will permit; do

not remove the securing bolts from the retaining cover at this stage.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT, WHEN DISCONNECTED, THE HARNESS CANNOT FALL INTO THE TANK.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION WHEN SEVERING THE PLASTIC CABLE TIES OR LACING CORD.

(4) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord (if fitted) and the ends of the plastic cable ties; remove and discard the lacing cord and the cable ties.

(5) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(6) Remove the conduit securing clip.

(7) Fit a suitable blank to the access hole, with the harness protected adequately and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE SURFACE FINISH OF THE RETAINING COVER.

(8) Note the location of the securing bolts, as one is used for electrical bonding purposes, then remove the bolts and O-ring seals, together with the bonding plate.

(9) Remove and discard the retaining cover O-ring seal.

D. Prepare to Install Probe

(1) Inspect the retaining cover and the bonding plate and ensure that they are free from contamination, damage and corrosion, and that the surface finish of each component is intact.

(2) Inspect the electrical cables and terminations and repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-49.

(3) Install a new O-ring seal on the retaining cover; lubricate the seal with clean, approved system fuel.

E. Install Probe (Ref. Fig. 401, 402 and 403) (Ref. Fig. 404)

(1) Comply with the electrical and fuel safety precautions.

(2) Attach the cable conduit to the probe, temporarily, with the P-clip, bolt and washer.

(3) Probes 1, 2, 3, 4, 5, 7 and 8: secure the clip so that the conduit is in line with the probe.

(4) Probe 6: secure the clip so that the conduit is at right angles to the probe.

(5) Probes 1, 2, 3, 4, 5 and 6: check that the conduit extends 95.0 mm (nominal) from the centre line of the P-clip (probes 1, 2, 3, 4 and 5) or the bolt (probe 6 only).

(6) Probes 7 and 8: check that the conduit extends 5.0 mm (nominal) beyond the edge of the clip.

NOTE: Plastic cable ties may be fitted as alternatives to lacing cord. The ties must be fitted in accordance with the Wiring Diagram Manual, 20-41-09.

Lacing cord must be secured with a clove hitch and a reef knot, with the cord ends terminating 0.25 in (6.35 mm) from the knot.

(7) Probes 1, 2, 3, 4, 5 and 6: secure the conduit to the probe with lacing cord as illustrated (Ref. Fig.401 and 402).

(8) Secure the cable terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49, ensuring that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(9) Route the cable along the probe, without twists or kinks, then make a coil of any spare cable.

(10) Probes 1, 2, 3, 4, 5, 6 and 8: make the coil

approximately two-thirds of the probe width and with a longitudinal diameter of 23.0 mm for probe 8, or 36.0 mm for probes 1, 2, 3, 4, 5 and 6 (nominal values).

(11) Probe 7: loop the cable as illustrated (Ref. Fig. 403).

(12) Secure the cables to the probe with plastic cable ties and lacing cord.

(13) Refer to paragraph 2.C.(8), then, with the bonding plate held on the retaining cover and the identification number uppermost, pass the securing bolts, in their correct locations, through the bolt holes in each component, and fit new O-ring seals; lubricate the seals with clean, approved system fuel.

(14) Pass the probe into the tank with the cutaway in the retaining cover aligned with the locating dowel in the wing.

(15) Press the cover fully into place and secure it and the bonding plate with the securing bolts; torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(16) Check that the electrical bonding is in accordance with 20-27-11.

F. Conclusion

(1) Reset the circuit breakers tripped before probe removal.

(2) Refuel the tank as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(3) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test; for dummy probe 8 only, perform the appropriate section (High Level and Overfull) of the Functional Test detailed in 28-42-00, Adjustment/Test.

(4) Remove all tools and equipment from the area; remove the warning placard from the flight compartment.

PROBES, TANKS 6 AND 7 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

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1. General (Ref. Fig.401, 402 and 403), (Ref. Fig.404, 405 and 406) and (Ref. Fig.407)

   A. Each probe installation, for tanks 6 and 7 wing cells, comprises five full-length FQI probes and one dummy probe. In these instructions the probes are numbered from 1 to 6 for clarity. Nos.1, 2, 3, 4 and 5 are full-length probes and No.6 is the dummy probe.

   The locations and functions of the probes in each wing tank are similar, except that whereas all the full-length probes in tank 6 are simple FQI probes, in tank 7 probe 2 is also fitted with Overfull and High Level sensors, and probe 5 accommodates a capacitance index compensator (CIC). The dummy probes, which are similar, are bracket-mounted within the tanks to provide locations for Overfull and High Level sensors.

   To aid installation, receptacles are installed in the tank floor at the Nos.1, 2, 3 and 4 probe positions, because of the acute angle of probe 5, a guide chute is provided. When installed the probes are held in position by locating feet and spring-loaded retaining covers.

   With the exception of dummy probe 6, all the probes are accessible from the wing top surface, and their identification numbers are engraved on the retaining covers. However, due to the wing profile it may be necessary to partially defuel the tanks for probe removal. As the dummy probes are accessible only from within the tanks, any residual fuel must be drained for removal/installation purposes.

   The No.6 tank fuselage cell, which is located between the Nos.6 and 7 tank wing cells and tanks 2 and 3, houses three probes. These probes are installed in individual canisters, which aid installation and provide locations for the upper ends of the probes, by means of spring cap assemblies. The front and centre probes, Q1153 and Q1152, are simple FQI probes. The rear probe, Q1151, accommodates a capacitance index compensator (CIC). Access to the front probe, which is offset, is by means of a detachable panel. Access to the centre and rear probes is direct from the fuselage bottom skin, through the medium of retaining covers. Electrical connections to all the probes are internal, but with the exception of dummy probe 6, are made with the probes partially removed from the tanks.

The following procedure deals separately with the wing cell and fuselage cell probes, but the 'Equipment and Materials', 'Prepare to Remove Probes' and 'Conclusion' paragraphs are applicable to both types of probe.

**ON A/C 001-006,

NOTE: FQI Probe Connections

It is imperative that the tightening methods laid down in the Maintenance Manual are adhered to.

Physically check the cable terminations for movement to ensure that it is effectively clamped.

B. Concorde Service Newsletter 0206-28. FQI 1153

RETAINING COVER/BOLTS

A hidden failure discovered on an in-service aircraft, and the origin of which could be traced back to the installation in tank No.6 of a FQI probe, using a non-appropriate mounting collar assembly.

As a result, although retaining cover and original end cap have been adapted, BIHEX 12 bolt not being installed according to the basic design, perforated a seal nut of the mounting collar assembly.

In order to eliminate the above problem, it is mandatory that, during the first replacement of involved FQI probe, all items making up the FQI probe assembly be checked to ensure they correspond to one of the two initial schemes.

NOTE: There are two possible schemes for the installation of the FQI probes:

- Aircraft 203-212 G-BOAA to AE, with FQI probe end cap equipped with captive 12 point pan head bolts (Pre-mod.R.0366).

- Aircraft 013-G-BOAG and AF and subsequent, with FQI probe collar assembly equipped with captive CSK head bolts (Post-mod.R.0366).

In case a fuel leak is evidenced, the following need be performed:

- Removal of corresponding FQI probe assembly (Ref. 28-44-33).

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B B B B - Checking that seal nuts on mounting collar are leakproof. If it is found that a too long bolt caused damage to one of the nuts, replace damaged nut (Refer to IPC 28-44-30).

B B - Reinstallation of FQI probe assembly (Ref. 28-44-33), respecting the position of bolts on assembly.

2. Probes

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Fuel gauge probe cover extractor, for No.6 tank fuselage cell probe	D925259000

B. Prepare to Remove Probe

NOTE: If a probe is to be renewed, for other than a gauging fault, before it is removed from the aircraft an Operational Test of the associated tank FQI system must be performed (Ref. 28-40-00, Adjustment/Test).

(1) If dummy probe No.6, or a fuselage cell probe is to be removed, defuel the appropriate tank completely as detailed in 28-25-00. For the removal of the remaining probes partially defuel the tank as necessary, or transfer fuel as detailed in 28-22-00. Gain access to a wing cell, as required, as detailed in 28-10-00.

(2) Ensure that the ground refuel panel 1-194 is closed.

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switch is inadvertently operated.

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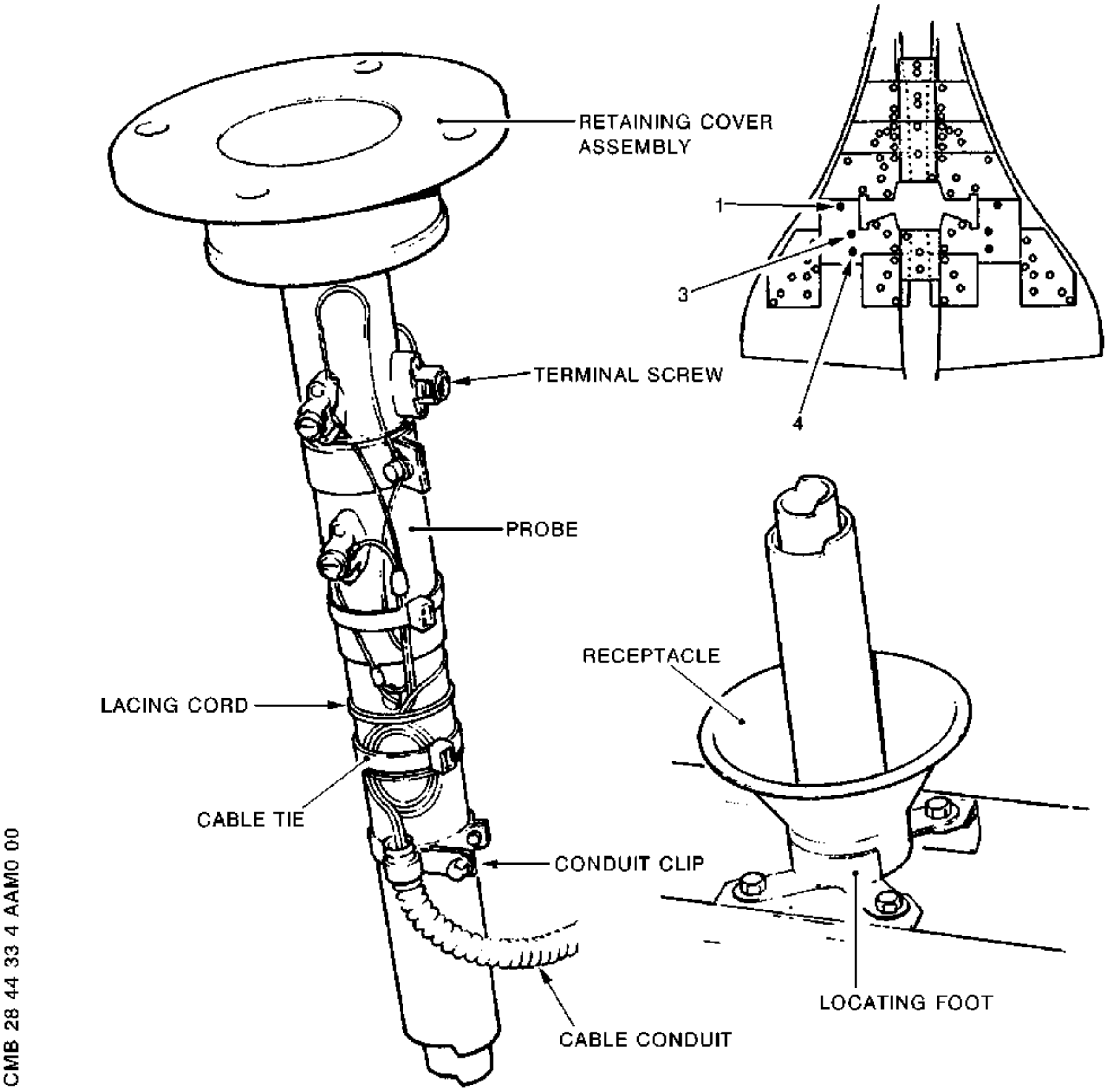

Wing Cell Probes 1, 3 and 4 - Typical Installation
Figure 401

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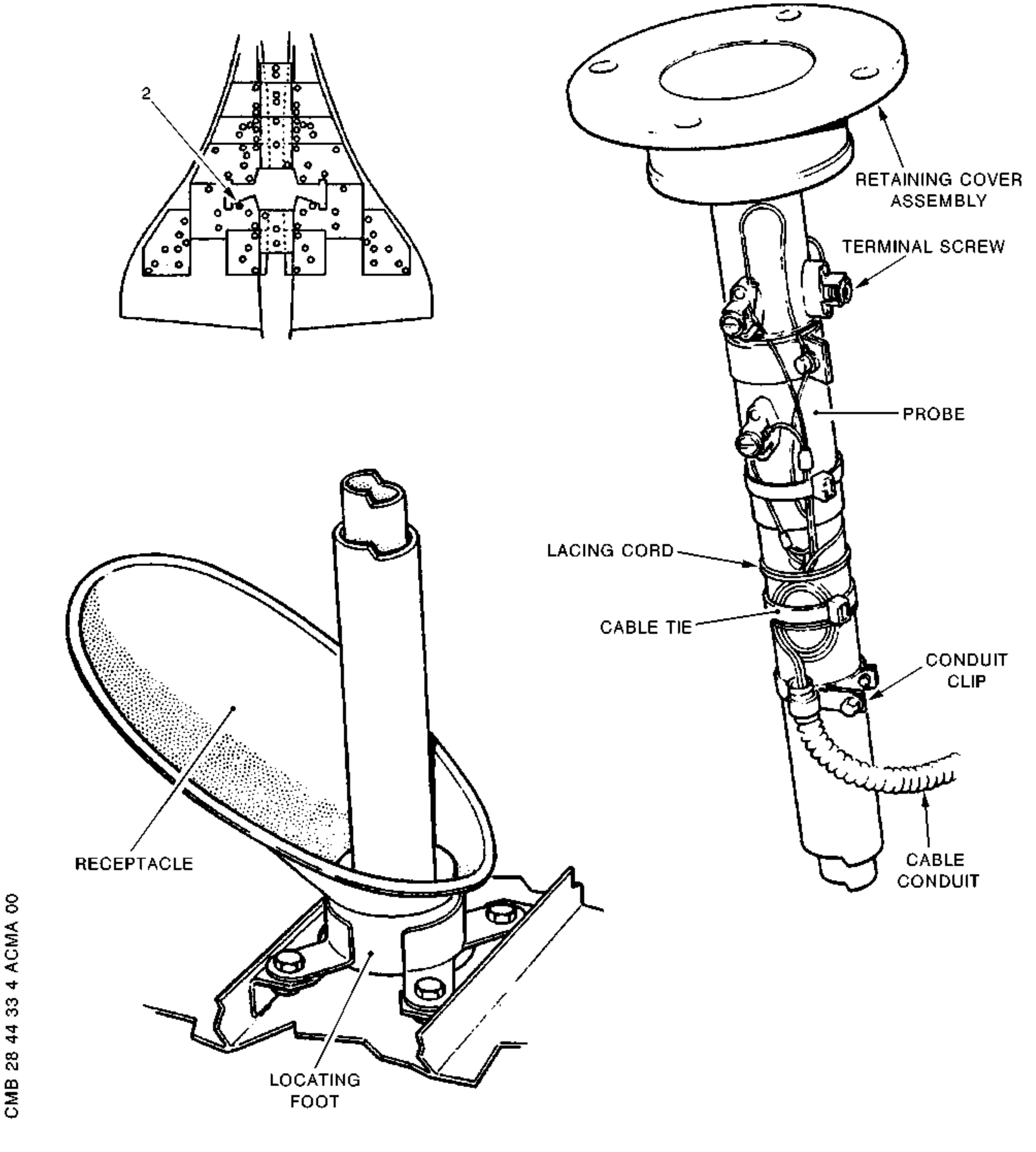
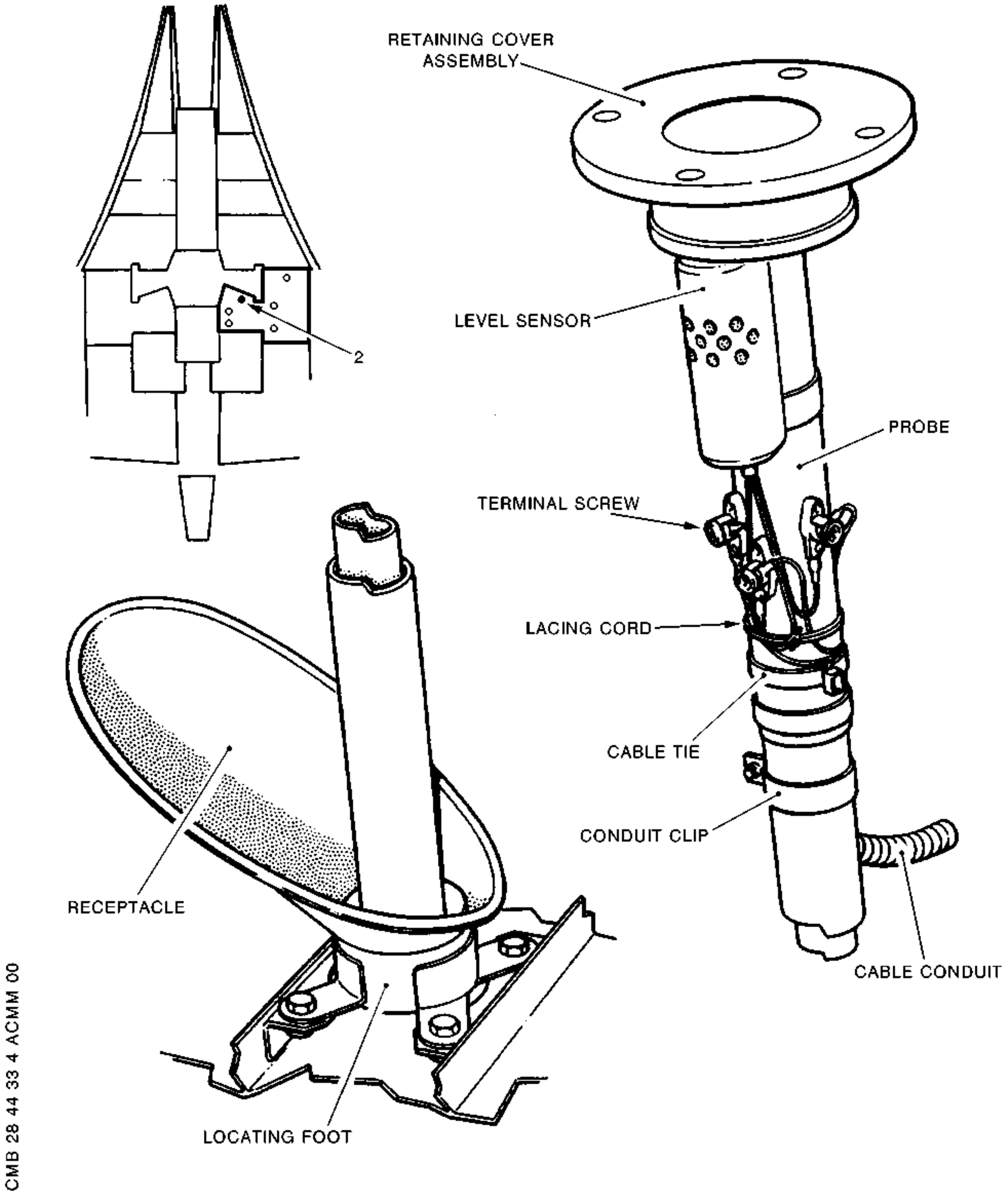


Tank 6 Wing Cell Probe 2 - Installation
Figure 402 (Sheet 1 of 2)



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Tank 7 Wing Cell Probe 2 - Installation
Figure 402 (Sheet 2 of 2)

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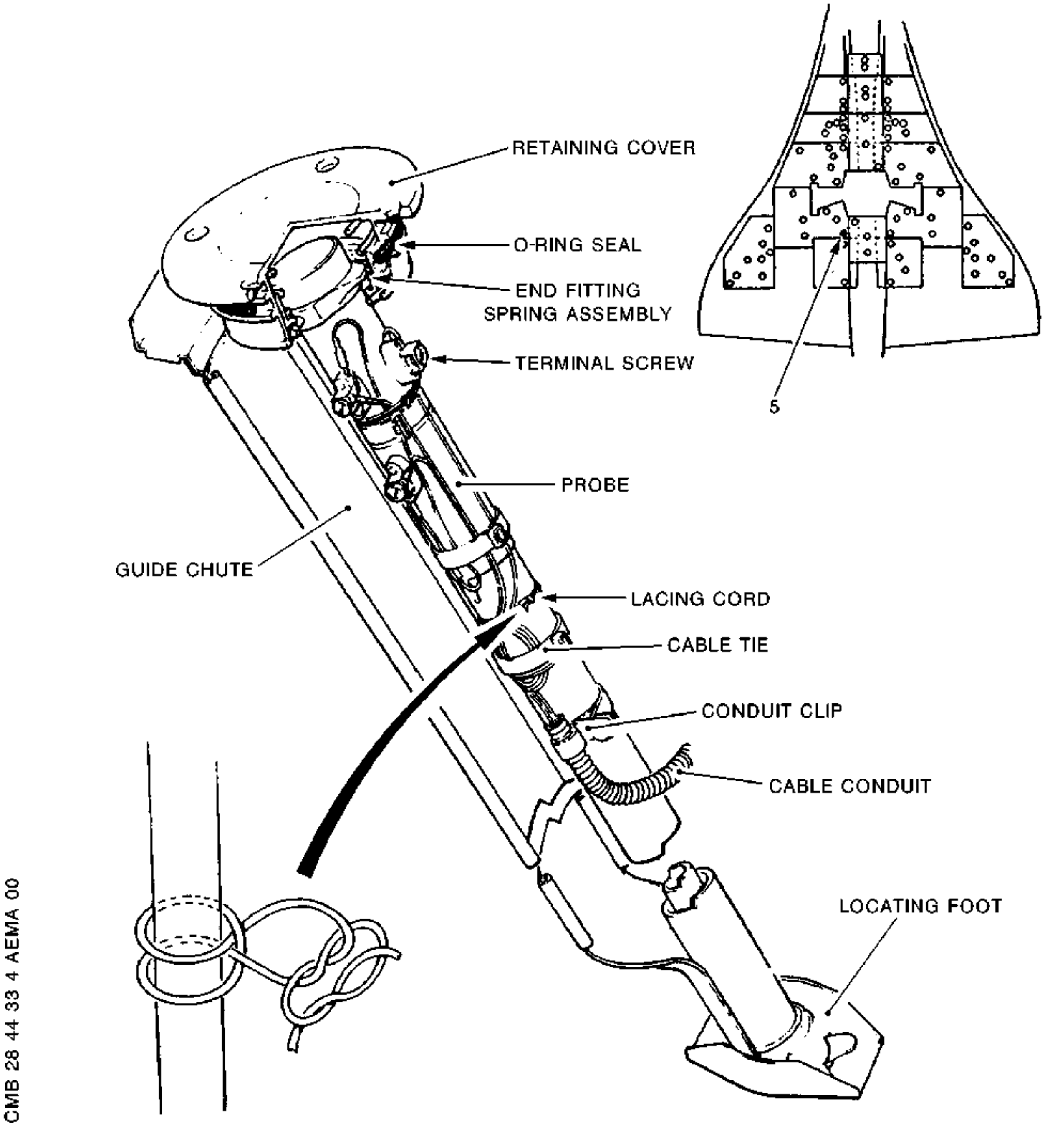
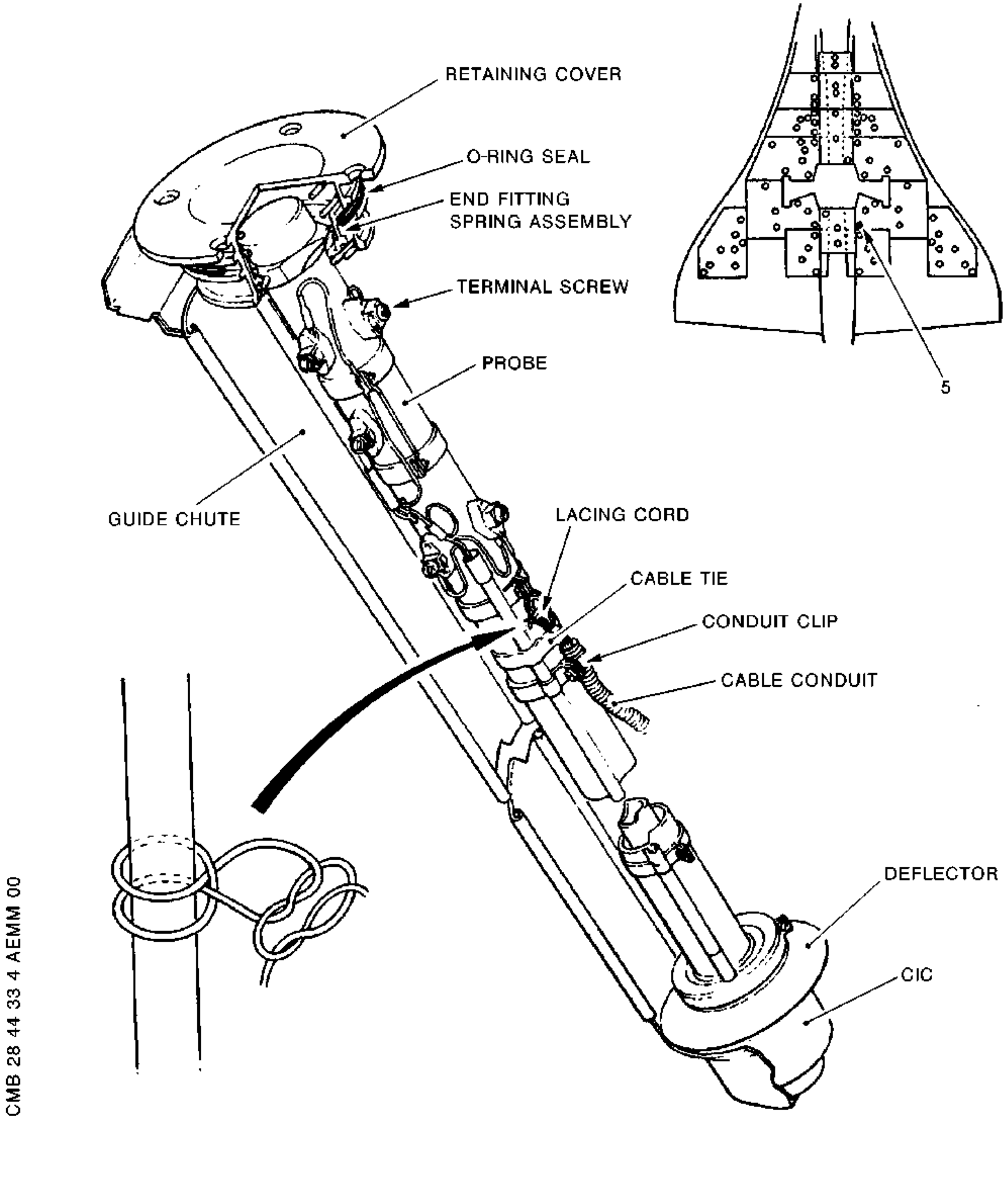


Tank 6 Wing Cell Probe 5 - Installation
Figure 403 (Sheet 1 of 2)



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Tank 7 Wing Cell Probe 5 - Installation
Figure 403 (Sheet 2 of 2)

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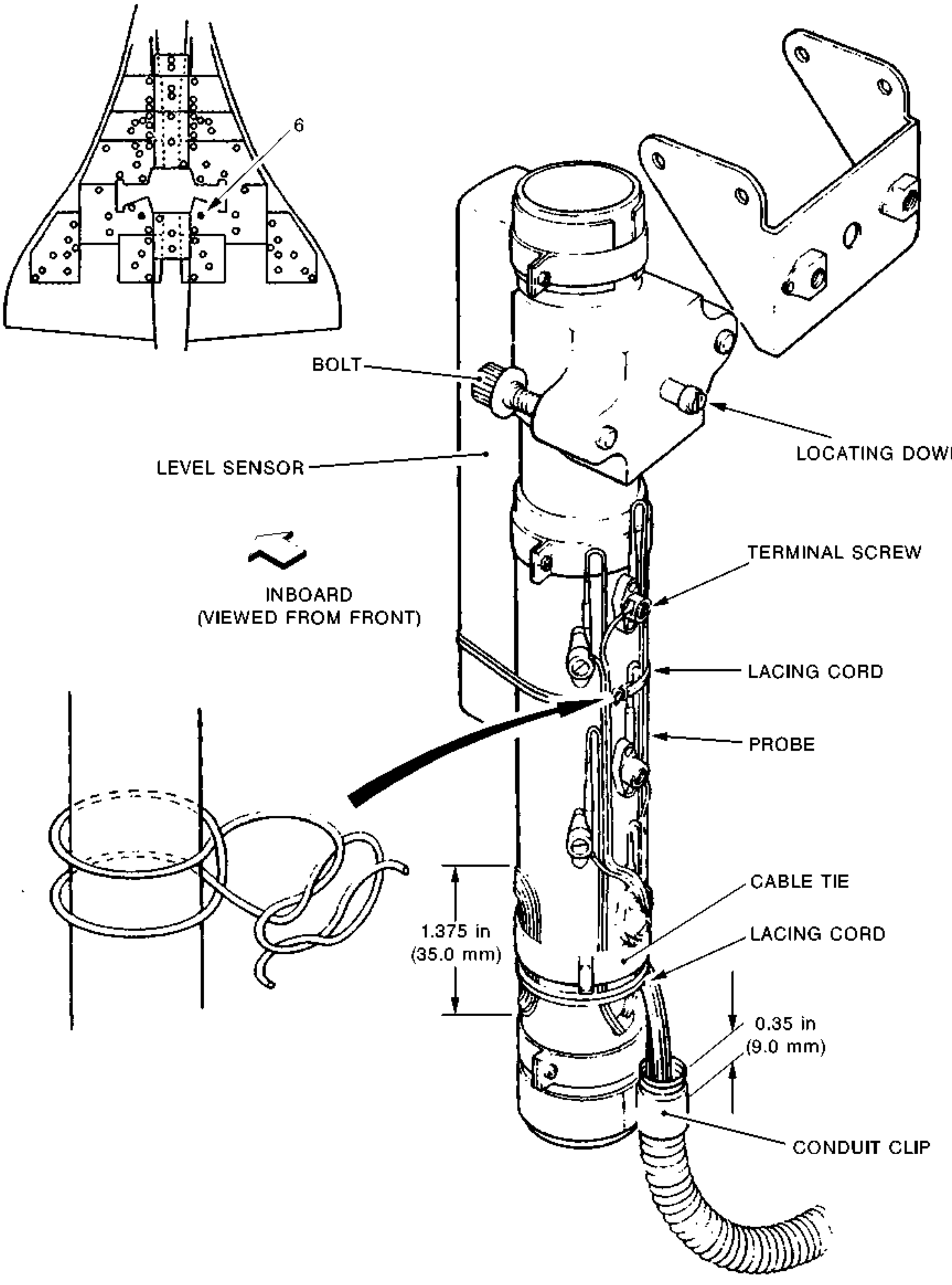

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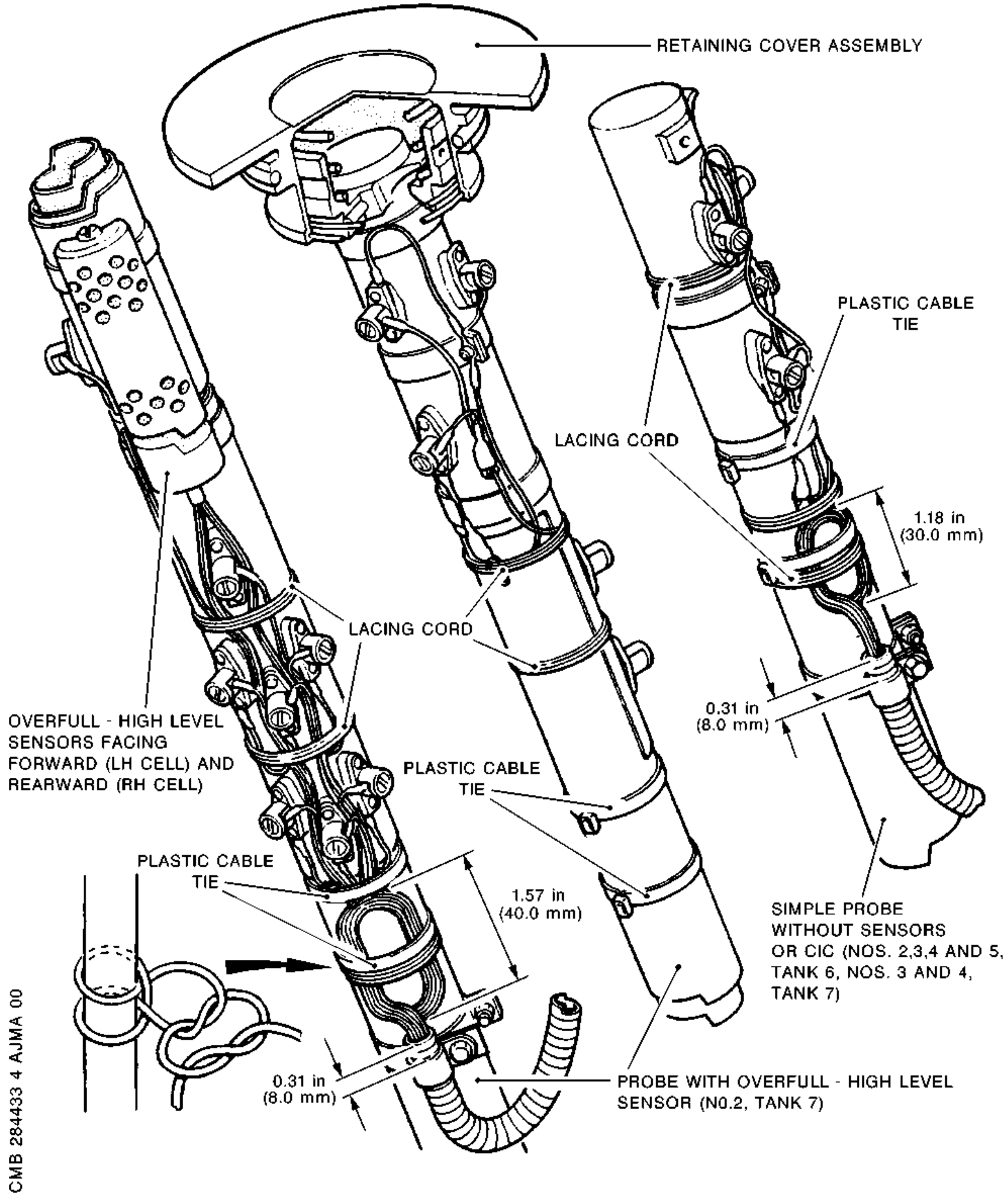
Wing Cell Dummy Probe 6 - Installation
Figure 404



Wing Cell Probe Wiring Installation (Typical)
Figure 405 (Sheet 1 of 2)

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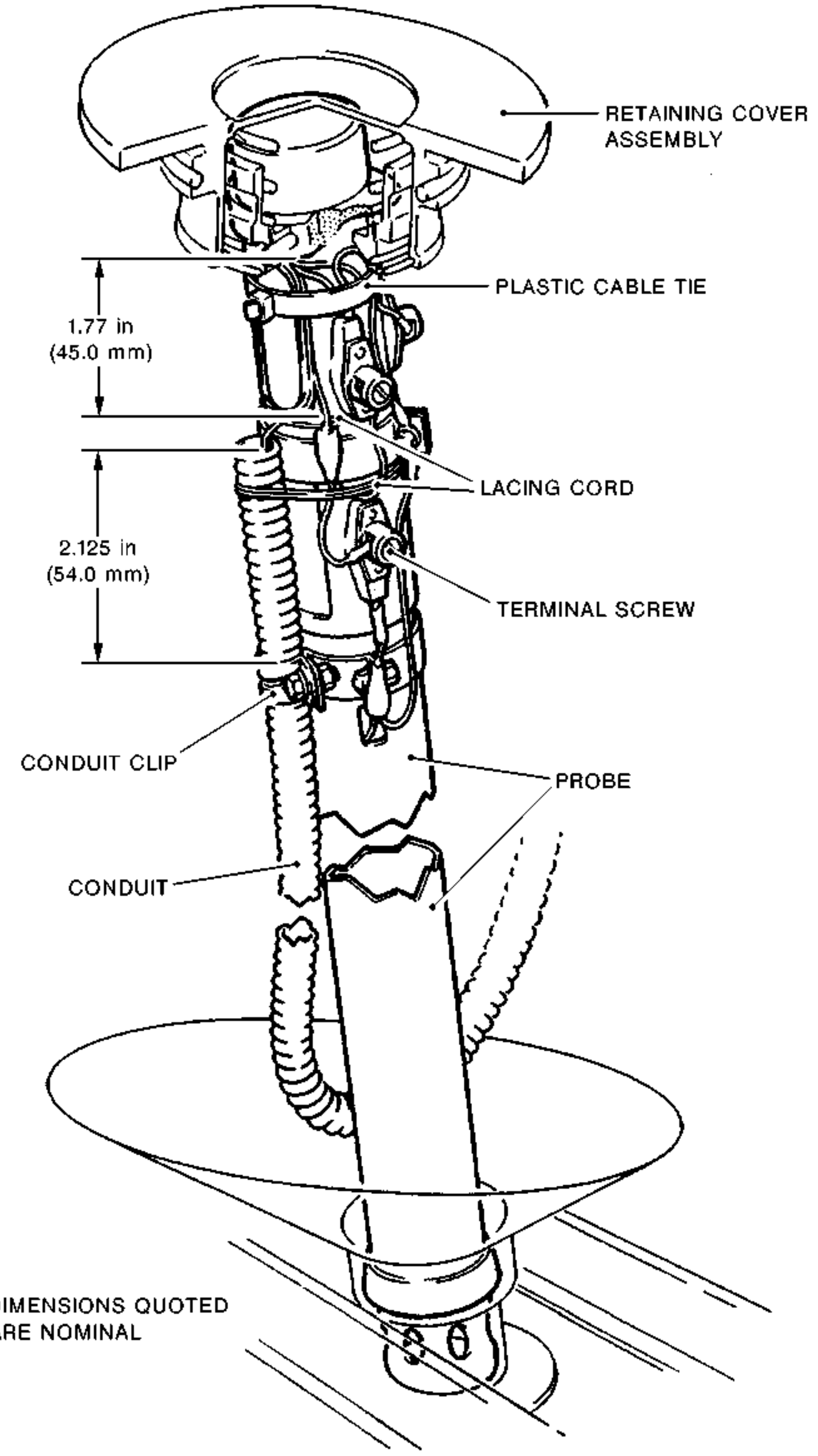

NOTE: DIMENSIONS QUOTED
ARE NOMINAL

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Wing Cell Probe Wiring Installation (Probe 1)
Figure 405 (Sheet 2 of 2)

(4) Isolate the electrical supplies to the probe by tripping the appropriate circuit breakers. Fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected, it is suggested that all circuit breakers listed are tripped, for both tanks 6 and 7, irrespective of the probe location.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F 8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D 5
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C 2
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22

C. Remove Wing Cell Probe 1, 2, 3, 4 or 5 (Ref. Fig.401, 402 and 403) (Ref. Fig.404, 405 and 408)

NOTE: Due to the restricted length of the free conduit between the tank harness and the conduit clip on the probe (all probes except dummy probe 6), two operators may be required to perform the necessary electrical disconnection procedures for probe removal.

PROBE LOCATION	PROBE IDENT. LEFT CELL	PROBE IDENT. RIGHT CELL
1	Q1155	Q1102
2	Q1154	Q1103
3	Q1158	Q1104
4	Q1157	Q1105
5	Q1156	Q1106
6	Q1337	Q1400

Probe Identification
Table 401

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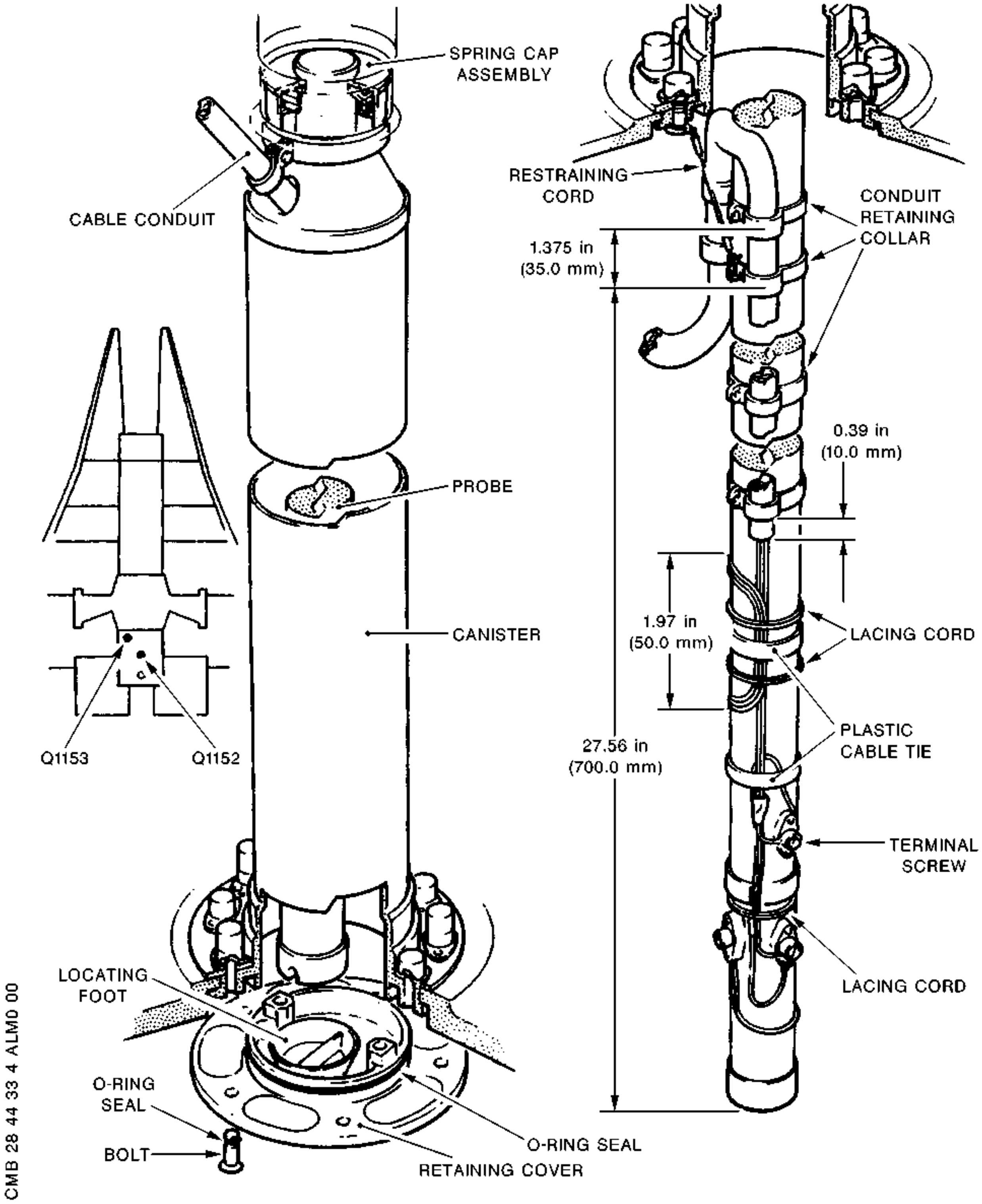
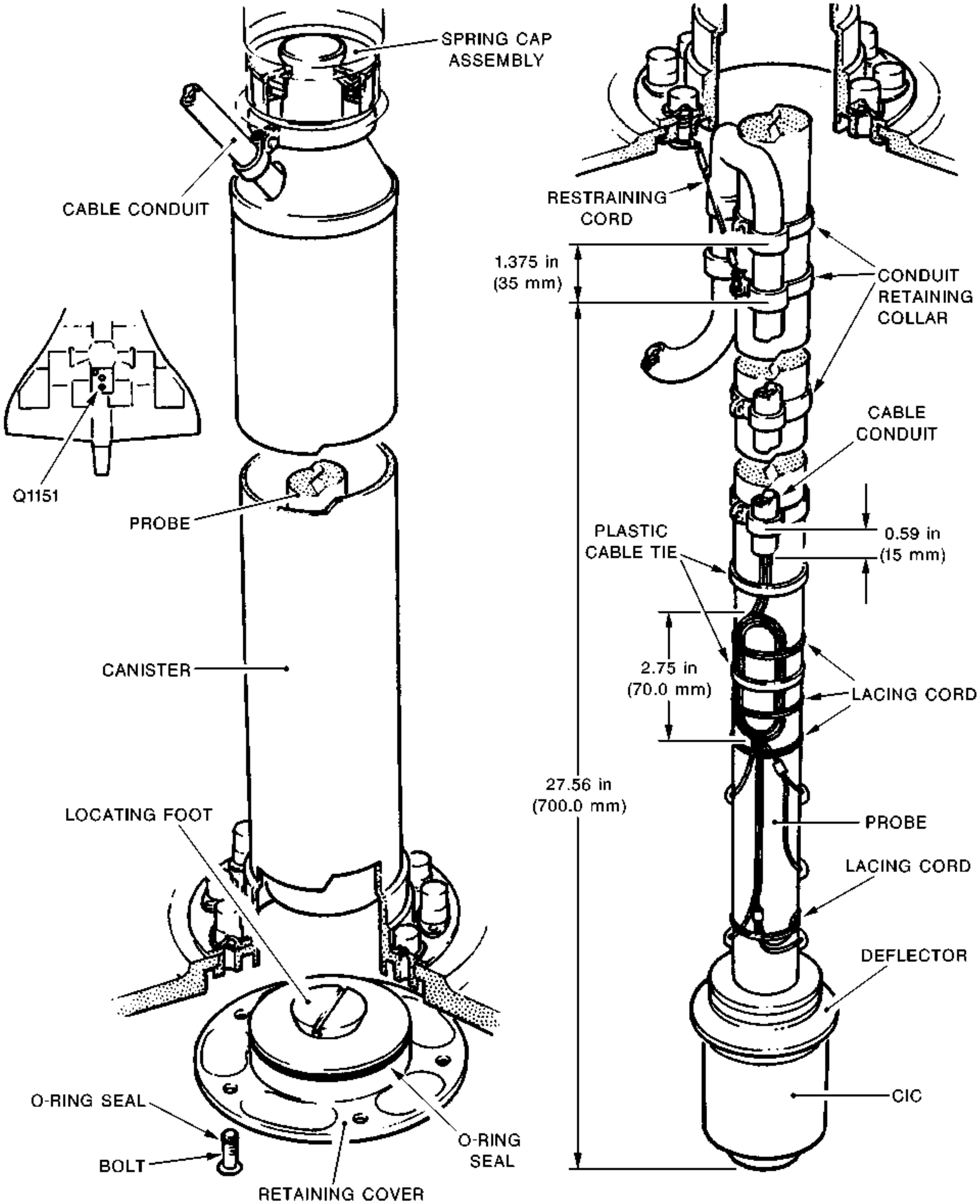


Fuselage Cell, Front and Centre Probes - Installation
Figure 406



Fuselage Cell, Rear Probe - Installation
Figure 407

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(1) Refer to Table 401 to identify the probe to be removed. The full-length probes are identified front to rear (as far as practicable) for both wing tanks. Dummy probe 6 is situated (offset) between probes 2 and 5.

NOTE: Before a probe is removed, the position of the retaining cover in relation to the surrounding structure should be noted to aid installation.

(2) Unscrew the securing bolts sufficiently to disengage the threads. Ease the retaining cover, together with the bolts and O-ring seals, from the tank sufficiently to check that the fuel level is below the access hole. If necessary defuel the tank further.

(3) When the fuel level is satisfactory, withdraw the probe (full-length) far enough to note the axes of the pivot-pins and locating lug in relation to the retaining cover, to facilitate subsequent installation.

(4) Withdraw the probe as far as the electrical conduit will permit.

NOTE: Probe 5: the guide chute will support the probe as it is withdrawn.

Probes 1, 2, 3 or 4: the bottom end of the probe will ride up the bowl of the locating receptacle initially, then the probe will hang freely.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(5) Using end-cutters or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord and the ends of the plastic cable ties. Remove and discard the lacing cord and cable ties.

(6) Remove the conduit-securing clip.

(7) Probe 1: sever the conduit lacing cord.

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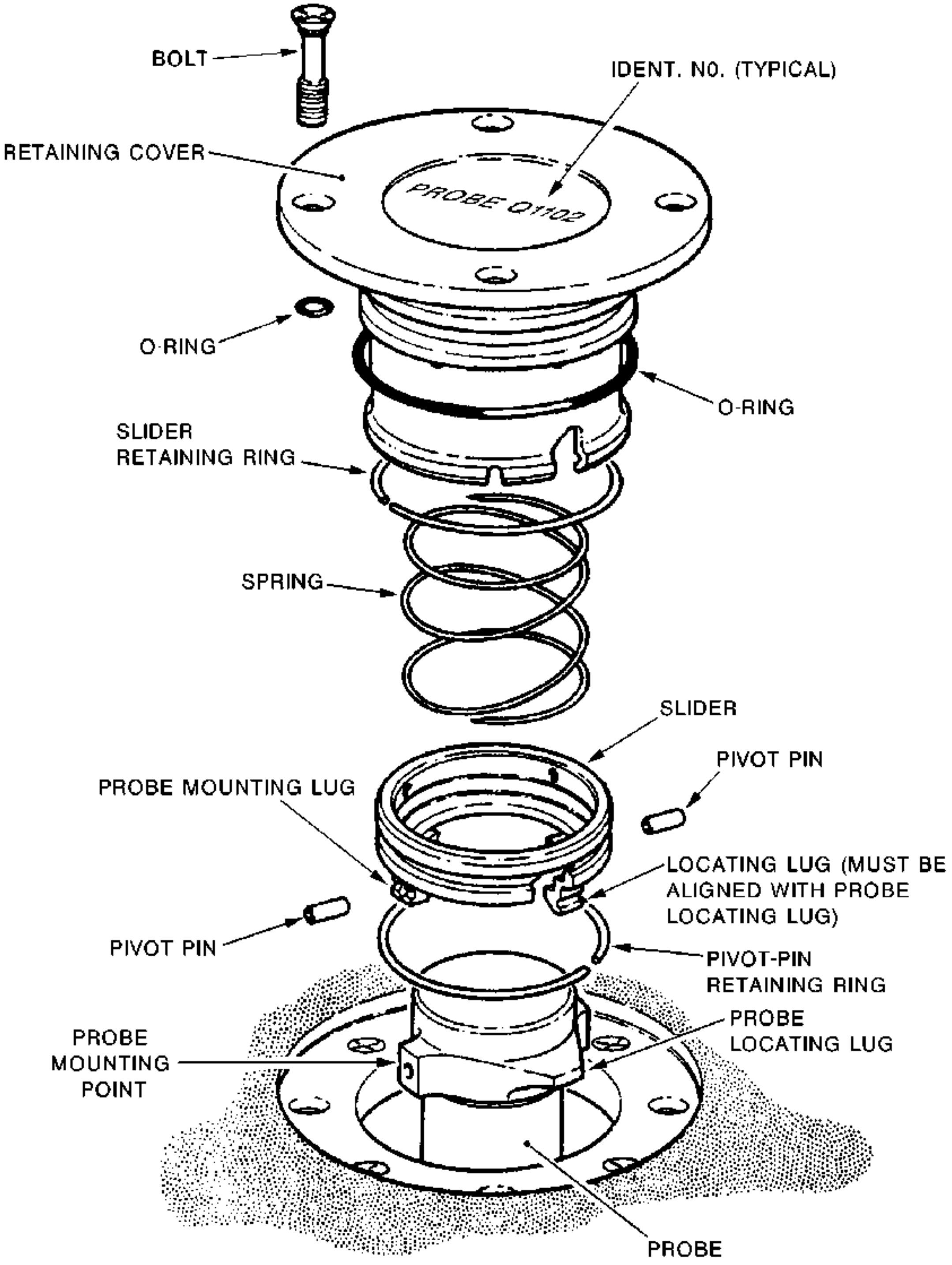

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Typical Wing Cell Probe Retaining Cover
Figure 408 (Sheet 1 of 2)

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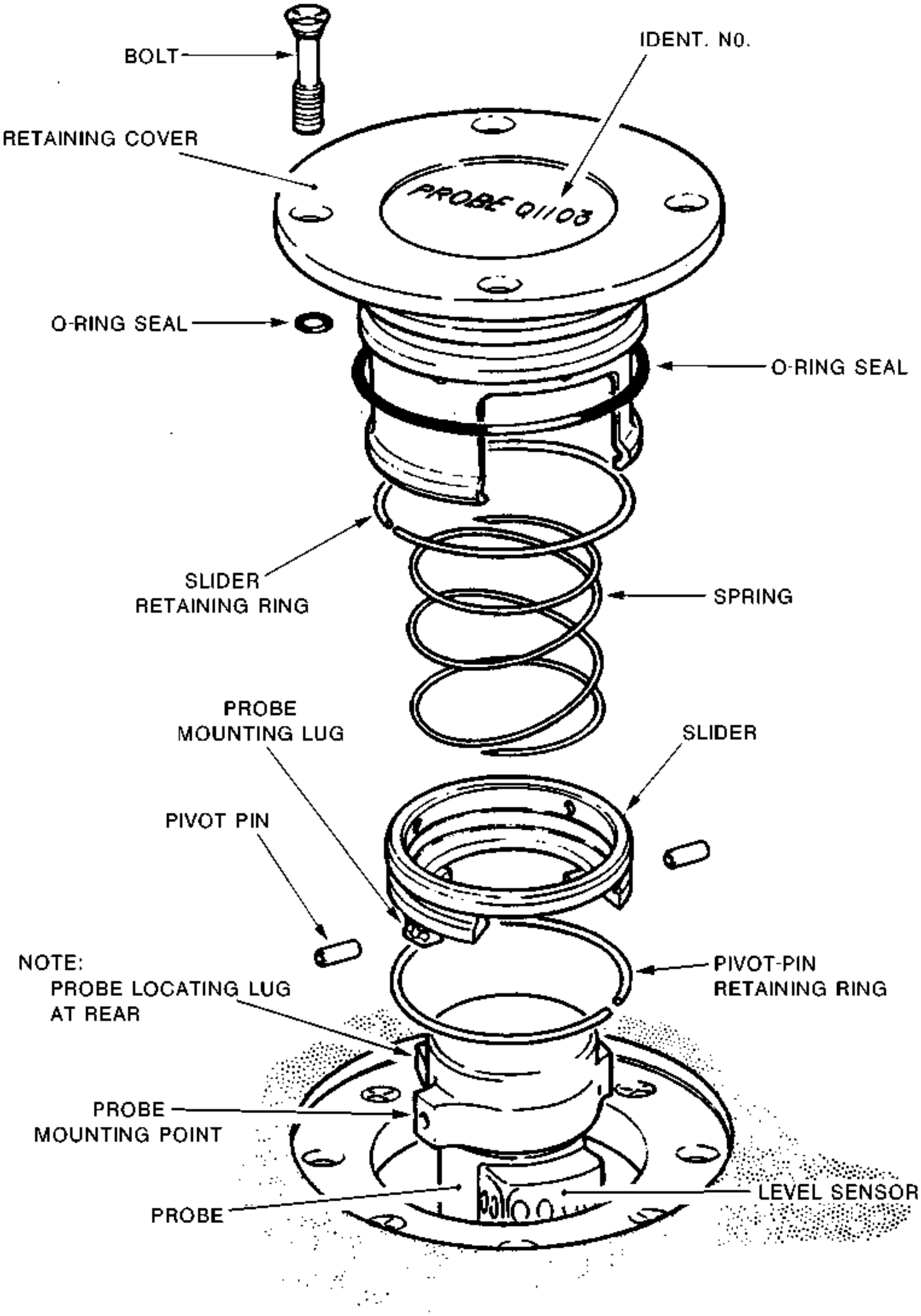

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Tank 7, Probe 2 Retaining Cover
Figure 408 (Sheet 2 of 2)

(8) Uncoil the spare cable and withdraw the probe from the tank.

(9) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(10) Fit a suitable blank to the access hole, with the harness protected adequately and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(11) With the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:

(a) Note the position of the securing bolts, as one is used for electrical bonding purposes, then remove the O-ring seals and the bolts. Discard the seals.

(b) Compress the spring and remove the slider-retaining ring.

(c) Gradually release the spring compression and withdraw the probe and slider assembly from the retaining cover. Remove the spring.

(d) Remove the pivot-pin retaining ring.

(e) Support the slider and withdraw the pivot-pins.

NOTE: The pins are provided with an internal UNC3B screw thread for extraction purposes.

(f) Remove and discard the O-ring seal from the retaining cover.

D. Remove Wing Cell Dummy Probe 6 (Ref. Fig.404)

(1) Defuel the appropriate tank as detailed in 28-25-00 and gain access as detailed in 28-10-00.

(2) Remove the conduit-retaining clip.

(3) Support the probe and unscrew the securing bolts.

(4) Using end-cutters or side-cutters, with the blades held flat against the probe, sever the knot securing the lacing cord and the end of the plastic cable tie. Remove and discard the lacing cord and the cable tie.

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CAUTION: ENSURE THAT ALL PIECES OF LACING CORD AND CABLE TIES ARE ACCOUNTED FOR AND REMOVED FROM THE TANK.

(5) Attach the electrical harness temporarily to a suitable point within the tank.

(6) Remove the probe, complete with securing bolts, from the tank and temporarily replace the tank access panel.

E. Prepare to Install Wing Cell Probe (Ref. Fig.408)

(1) Probes 1, 2, 3, 4 or 5.

(a) Inspect the retaining cover and ensure that it is clean and free from contamination, damage and corrosion, and that the paint finish is intact.

(b) With the probe supported in a suitable clamp, assemble the spring cap assembly as follows:

b1) Install a new O-ring seal in its groove in the retaining cover. Lubricate the seal with clean, approved system fuel.

b2) Probes 1, 2, 3, 4 or 5, tank 6 and probes 1, 3, 4 or 5, tank 7: position the slider over the top of the probe with the locating lugs aligned (Ref. Fig.408, Sheet 1).

b3) Probe 2, tank 7: position the slider over the top of the probe with the cut-out section at 180 deg to the probe locating lug (Ref. Fig.408, Sheet 2).

b4) Insert the pivot pins and install the pivot pin retaining ring.

b5) Insert the spring in the retaining cover.

b6) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed in its groove.

b7) With the slider retaining ring in position, gradually release the tension on the spring.

b8) Probe 2, tank 7: ensure that the cut-out section of the retaining cover coincides with the cut-out section of the slider, to accommodate the overfull/high level sensor.

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(2) Dummy probe 6: check that the mounting bracket is free from cracks or corrosion, the mounting face is undamaged and the anchor nuts are secure.

(3) Inspect the electrical cables and terminations. Repair as necessary in accordance with the Wiring Diagram Manual, 20-42-49.

F. Install Wing Cell Probes 1, 2, 3, 4 or 5 (Ref. Fig.401, 402 and 403) (Ref. Fig.405)

(1) Comply with the fuel and electrical safety precautions.

(2) Route the electrical cable along the probe, without twists or kinks. Secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(3) Pass the probe partly into the tank and secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.31 in (8.0 mm) of conduit protrudes beyond the clip (2.125 in (54.0 mm) probe 1 only), to ensure the security of the conduit. Secure the conduit to probe 1 with lacing cord, as shown (Ref. Fig.405).

(4) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width and a longitudinal diameter as follows:

(a) Tank 6 or 7, probe 1: 1.77 in (45.0 mm).

(b) Tank 6, probes 2, 3, 4 or 5: 1.18 in (30.0 mm).

(c) Tank 7, probes 3 or 4: 1.18 in (30.0 mm).

(d) Tank 7, probes 2 or 5: 1.57 in (40.0 mm).

NOTE: The above dimensions are nominal.

(5) Secure the coil with a length of lacing cord and a plastic cable tie. Secure the table tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and reef knot and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

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(6) Refer to paragraph (4) and secure the remaining cable to the probe with cable ties and lacing cord, as appropriate.

NOTE: To complete the installation satisfactorily, each probe must be positioned correctly in the tank in relation to its receptacle (probes 1, 2, 3 or 4) or guide chute (probe 5) and the retaining cover, as appropriate.

(7) Refer to the NOTE preceding paragraph C.(2).

(a) Probe 5: rotate the probe as necessary in the retaining cover, until the locating lug at the top of the probe is positioned at 180 deg to the centre line of, and the pivot-pins are parallel with, the guide chute.

NOTE: Probe 2, tank 7: the cut-outs in the retaining cover and the slider must be aligned and positioned over the overfull/high level sensor.

(b) Probes 1, 2, 3 or 4: lower the probe until it engages the bowl of the receptacle.

(c) Probe 2, tank 7 only: position the probe so that the overfull/high level sensor faces inboard toward the longitudinal axis of the aircraft and the probe locating lug faces outboard.

(8) Slide the probe carefully along the guide chute (or receptacle) until the base of the probe engages the location foot.

CAUTION: IF ANY UNDUE RESISTANCE IS FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY AND INVESTIGATE THE CAUSE.

B IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
B POSITIONED IN LOCATING FOOT, THEN VISUALLY VERIFY
B BY EITHER REMOVING AN ADJACENT FUEL TANK ACCESS
B PANEL OR DEFUELLING AND ENTERING THE APPROPRIATE
B FUEL TANK (REF. 28-25-00). FAILURE TO LOCATE
B PROBES CORRECTLY CAN RESULT IN STRUCTURAL DAMAGE
B TO FUEL TANK WALLS.

NOTE: Probes 1, 2, 3 or 4: if no spring resistance is felt the probe is not located correctly in its receptacle and must be removed and reinserted.

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(9) Rotate the retaining cover, if necessary, until, when pressed down by hand against the spring, it seats flat into the recess in the wing.

(10) Install the bolts, complete with O-ring seals, in their correct locations in the retaining cover, as previously noted (Ref. para. C.(4)(a)). Lubricate the seals with clean, approved system fuel.

(11) Secure the cover to the tank with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(12) Check that the electrical bonding is in accordance with 20-27-11.

G. Install Wing Cell Dummy Probe 6 (Ref. Fig.404)

(1) Comply with the fuel and electrical safety precautions.

(2) Position the probe on the mounting bracket, with the dowel engaged in its locating hole.

(3) Secure the probe with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(4) Route the electrical cable along the probe, without twists or kinks. Secure the terminations to the terminals in accordance with the Wiring Diagram Manual 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.90 and 0.102 mdaN).

(5) Secure the conduit to the probe with the conduit clip. Ensure that a nominal 0.35 in (9.0 mm) of conduit protrudes beyond the clip (to ensure the security of the conduit).

(6) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 1.375 in (35.0 mm) nominal. Secure the coil with a length of lacing cord and a plastic cable tie. Secure the table tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the upper runs of cable with lacing cord as shown. Secure the core with a clove hitch and a reef knot and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

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R (7) If it was necessary to remove a fuel tank access panel to verify the correct location in the locating foot, prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (8) Check that the tank is free from any foreign objects (tools or debris, etc.) then refit the access panel as detailed in 28-10-00.

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H. Remove No.6 Tank Fuselage Cell Probe (Ref. Fig.406, 407 and 409)

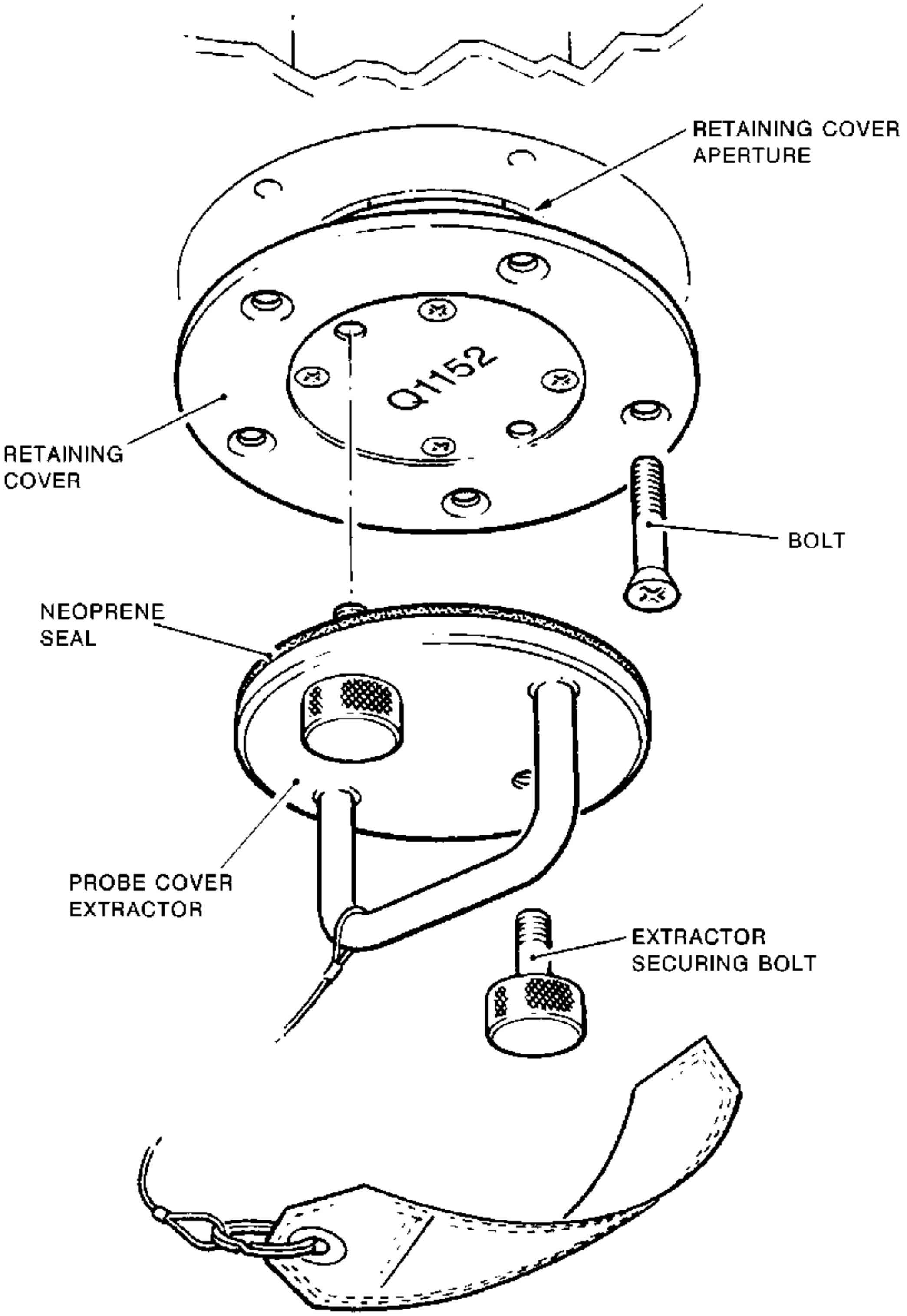
NOTE: Access to the rear probe is gained by the removal of panel 195 BB.

(1) Identify the probe to be removed by referring to the equipment identification number engraved on the retaining cover, Q1153 front, Q1152 centre and Q1151 rear.

(2) Loosen and partially unscrew the ring of securing bolts. Keep the retaining cover pressed upward, to guard against the possibility of the pre-load spring at the opposite end of the probe forcing the probe and cover out the tank. Remove the bolts together with their individual O-ring seals. Note the position of the bolts, as one bolt is used for electrical bonding purposes.

(3) Ensure that the extractor neoprene facing seal is undamaged and bonded correctly then secure the extractor to the retaining cover with the special bolts.

(4) Position a suitable container to catch any residual fuel, then, allowing for the spring force of the end fitting spring cap assembly, ease the cover partly from the tank. When the cover is withdrawn approximately 0.79 in (20 mm) hold the cover with the free hand and be ready to support the probe as the cover is removed completely from the tank.



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CMB 28 44 33 4 ASM0 00

Tank 6, Fuselage Cell, Probe Cover Extractor - Installation
Figure 409

(5) Disengage the probe from the locating foot in the retaining cover and remove the cover.

NOTE: A cable conduit is secured to the probe by a series of fixing collars. The lower of the upper pair of collars is also used as an anchorage for a restraining cord. This restraining cord is fitted with a metal loop for attachment to the tank structure, by means of a canister securing bolt, to support the probe during the wiring and fixing collar assembly procedures.

(6) Withdraw the probe carefully, to reveal the upper pair of conduit fixing collars and identify the nylon restraining cord.

CAUTION: USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(7) Using end-cutters or side-cutters, with the blades held flat against the probe, sever the knots securing the lacing cord, to free the restraining cord.

(8) Remove an adjacent bolt from the ring securing the probe canister then use the same bolt to fasten the metal loop on the end of the restraining cord to the tank structure. If necessary, loosen the collar-clamping bolt to permit the cord to position itself without kinking.

(9) Check that the probe is held securely before proceeding with the wiring disassembly.

(10) Loosen the terminal screws and withdraw the cable terminations.

(11) Refer to paragraph (7) and sever the remaining lacing cords, which retain the electrical cables.

(12) Sever the ends of the plastic cable ties and discard the ties.

(13) Release the collars securing the cable conduit to the probe, with the exception of the collar to which the restraining cord is attached.

(14) Support the probe and release the final collar, then carefully withdraw the probe from the tank, leaving the conduit supported by the restraining cord.

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(15) With the restraining cord still attached to the tank structure, stow the spare conduit and cable inside the canister, to prevent damage occurring.

J. Prepare to Install No.6 Tank Fuselage Cell Probe

(1) Inspect the retaining cover and ensure that it is clean and free from contamination, damage and corrosion and that the surface finish is intact.

(2) Install a new O-ring seal in the groove on the body of the retaining cover. Lubricate the seal with clean, approved system fuel.

(3) Discard the existing O-ring seals on the securing bolts and install new seals. Lubricate the seals with clean, approved system fuel. Do not change the position of the bolts as one is used for electrical bonding purposes.

(4) Inspect the electrical cables and terminations. Repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-29.

K. Install No.6 Tank Fuselage Cell Probe (Ref. Fig.406, 407 and 409)

(1) Comply with the fuel and electrical safety precautions.

(2) Pass the probe partly into the tank, then measure 27.56 in (700.00 mm) from the base of the probe and temporarily install the lower of the top pair of conduit retaining collars.

(3) Secure the collar to the probe, with conduit routed as shown in the appropriate figure, to ensure that the cables lead to the terminals at the correct angle.

(4) Ensure that the restraining cord is securely attached to the tank and that the probe is held securely.

(5) Temporarily install the top conduit retaining collar 1.375 in (35.00 mm) above the collar installed in paragraph (2) and in the same configuration.

(6) Temporarily install the remaining collars as follows:

(a) Front or centre probe: measure 8.66 in (220.00 mm) from the base of the probe and install the bottom collar. Install the three remaining collars at a pitch of 4.72 in (120.00 mm).

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(b) Rear probe: measure 15.75 in (400.00 mm) from the base of the probe and install the bottom collar. Install the remaining collar 21.65 in (550.00 mm) from the base.

(7) With all the collars temporarily installed in their correct positions on the probe, check that the conduit protrudes approximately 0.39 in (10.00 mm) (front or centre probe) or 0.59 in (15.00 mm) (rear probe), as appropriate, beyond the bottom clip. Tighten all the retaining collar securing bolts.

(8) Route the electrical cables along the probe, without twists or kinks. Secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

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(9) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width and a longitudinal diameter approximately 1.97 in (50.00 mm) (front or centre probe) or 2.75 in (70.00 mm) (rear probe), as appropriate.

(10) Secure the coil with a plastic cable tie and two lengths of lacing cord as illustrated. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and a reef knot and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

NOTE: Plastic cable ties may be used as alternatives to lacing cord.

(11) Secure the remaining cable to the probe with cable ties and lacing cord, as appropriate and as detailed in paragraph (10).

(12) Check that the retaining cover securing bolts are positioned correctly and that new O-ring seals are installed on them. Check that the O-ring seal is in place in its groove in the retaining cover, then lubricate all the seals with approved system fuel.

(13) Support the probe and remove the bolt used to secure the restraining cord to the tank structure. Replace the bolt and torque-tighten it to between 70 and 80 lbf in (0.791 and 0.940 mdaN).

(14) Secure the restraining cord to the probe with two lengths of lacing cord as detailed in paragraph (10).

(15) Make a final check of the conduit and cable for security of attachment.

(16) Slide the probe fully home, taking care not to kink or damage the cables, and hold it in position.

CAUTION: IF ANY UNDUE RESISTANCE IS FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY AND INVESTIGATE THE CAUSE.

IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY POSITIONED IN LOCATING FOOT, THEN VISUALLY VERIFY BY EITHER REMOVING AN ADJACENT FUEL TANK ACCESS PANEL OR DEFUELLING AND ENTERING THE APPROPRIATE FUEL TANK (REF. 28-25-00). FAILURE TO LOCATE PROBES CORRECTLY CAN RESULT IN STRUCTURAL DAMAGE TO FUEL TANK WALLS.

(17) Position the end of the probe in the foot on the retaining cover. Ease the cover into the canister, with the probe identification number at right angles to the fuselage axis and legible from the rear.

NOTE: To assist installation the retaining cover bolt holes are offset.

(18) Push the cover fully home and secure it with the bolts. Ensure that the earthing bolt is positioned correctly, as noted in paragraph (12). Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(19) Check that the electrical bonding is in accordance with 20-27-11.

L. Conclusion

(1) If it was necessary to remove a fuel tank access panel to verify the correct location in the locating foot, prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

NOTE: Any bonding lead which is found to be broken, frayed or with braid loose in the crimp is to be replaced before the next flight.

Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

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(2) If the No.6 tank fuselage cell rear probe has been replaced, refit access panel 195 BB.

(3) Reset the circuit breakers tripped before probe removal.

(4) Test the probe functions for tank 6 or 7 as follows:

(a) Perform the appropriate sections of 28-42-00, Adjustment/Test.

(b) If the probe was renewed for other than a gauging fault, perform, in addition to the above paragraph (a), the appropriate sections of 28-40-00, Adjustment/Test, 2. Operational Test.

(c) If the probe was renewed for a gauging fault, perform, in addition to the above paragraph (a) the appropriate sections of 28-40-00, Adjustment/Test, 3. Functional Test.

NOTE: In the case of a fuselage tank, because of the necessity to drain the tank for the associated probe removal from the bottom of the tank, the Operational Test referred to in paragraph (b), above, cannot be implemented. In these circumstances the capacitance section of the Functional Test detailed in paragraph (c) must be performed.

(5) Refuel the tank as detailed in 28-24-00 and test for leaks as detailed in 28-12-51, Adjustment/Test.

(6) Remove all tools and equipment from the area. Remove the warning placard from the flight compartment.

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PROBES, TANK 9 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 and 28-10-00.

1. General (Ref. Fig. 401, 402 and 403)
(Ref. Fig. 404, 405 and 406)

The probe installations for individual probes in both tank 9 wing cells (LH and RH) are similar, with all the probes being accessible from the wing top surface. However, because of the wing profile, it may be necessary to partially defuel a cell for probe removal.

The tank 9 fuselage cell is located between and to the rear of the wing cells. The two probes in this cell are accessible from the fuselage bottom surface. All electrical connections to the probes are internal and are made with the probes partially removed from the tanks. For the fuselage cell operation, it is assumed that the operator is facing the tank access door, with the nose of the aircraft to his left and the tail to his right.

R **ON A/C 001-006,

B NOTE: F.Q.I. Probe Connections

B It is imperative that the tightening methods laid
B down in the Maintenance Manual are adhered to.

B Physically check the cable terminations for movement
B to ensure that it is effectively clamped.

The following procedure deals separately with the wing cell and fuselage cell probes, but the 'Equipment and Materials', 'Prepare' and 'Conclusion' paragraphs are applicable to both types of probe.

2. Probes

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in	-

DESCRIPTION	PART NO.
(0.090 to 0.102 mdaN)	
Torque spanner, 50 to 60 lbf in (0.565 to 0.678 mdaN), for fuselage probe	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN), for wing cell probe	-

B. Prepare to Remove Probe

(1) If a wing cell probe is to be removed, partially defuel the appropriate cell, consistent with the probe location; for fuselage cell probe removal, defuel the cell, as detailed in 28-25-00.

(2) Isolate the electrical supplies to the probes by tripping the appropriate circuit breakers, including breakers Q1217, Q1218 and Q1219 for the wing cells only; fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected to channel A or B, both channels are isolated, irrespective of the probe location.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D5

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.

C. Remove Fuselage Cell Probe (Ref. Fig. 402)

NOTE: This probe removal/installation may require two operators.

(1) Identify the probe to be removed by referring to the tank access door 133-BB on which the probes are mounted in tandem. The probe equipment identification numbers are engraved on the retaining covers, Q1108 front and Q1137 rear.

(2) With a suitable container positioned to catch any residual fuel, and the retaining cover adequately supported against the pressure of the end fitting spring assembly, remove the ring of retaining bolts.

(3) Carefully ease the probe, which is approximately 3 ft (914 mm) long, from the tank, sufficiently to permit the electrical harness to be disconnected. Ensure that the probe clamp remains attached to the guide spring, to support the probe.

(4) Loosen the terminal screws and withdraw the cable terminations.

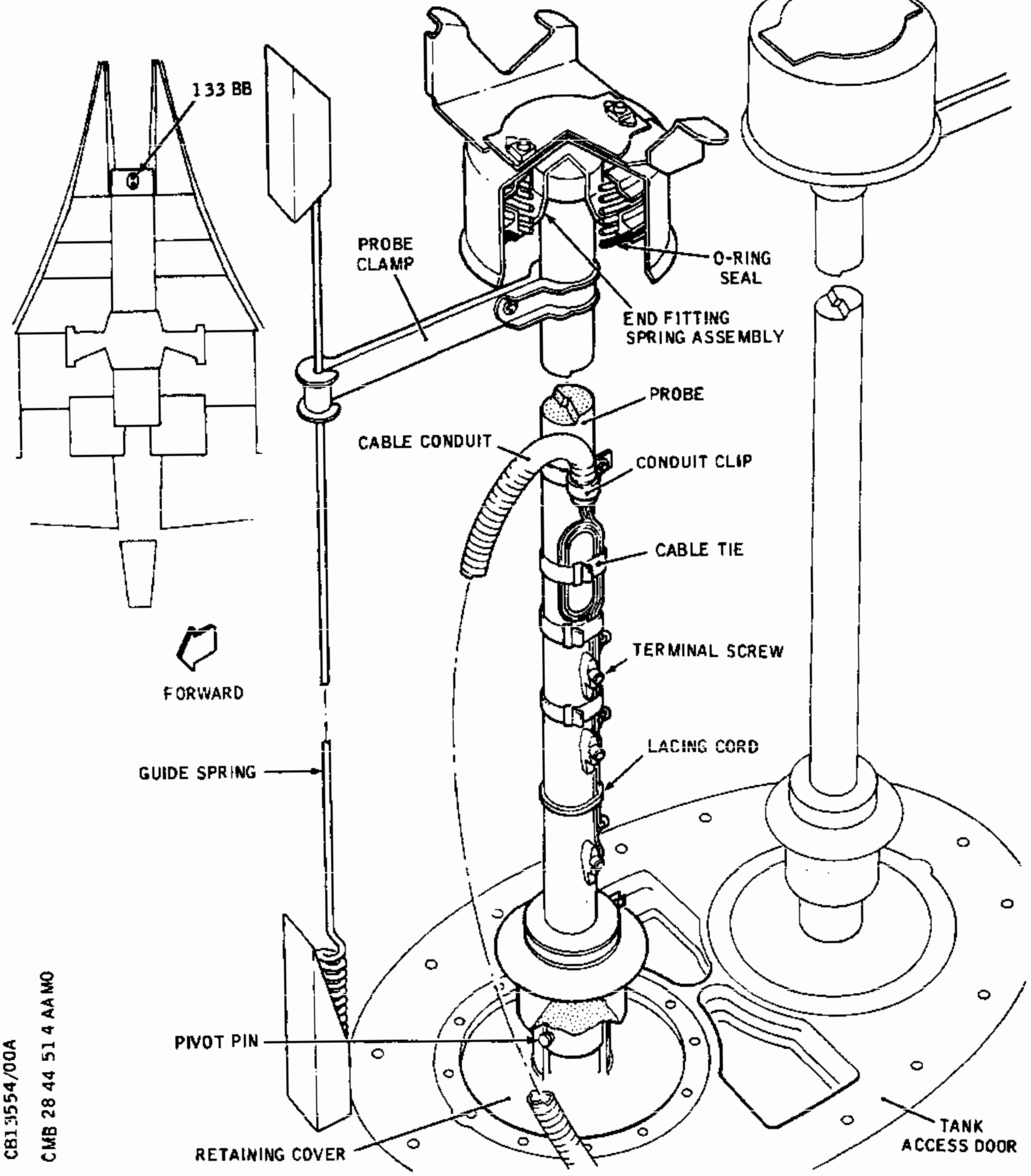
CAUTION: USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN THE LACING CORD AND PLASTIC TIES ARE SEVERED.

(5) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knot securing the lacing cord; remove and discard the cord.

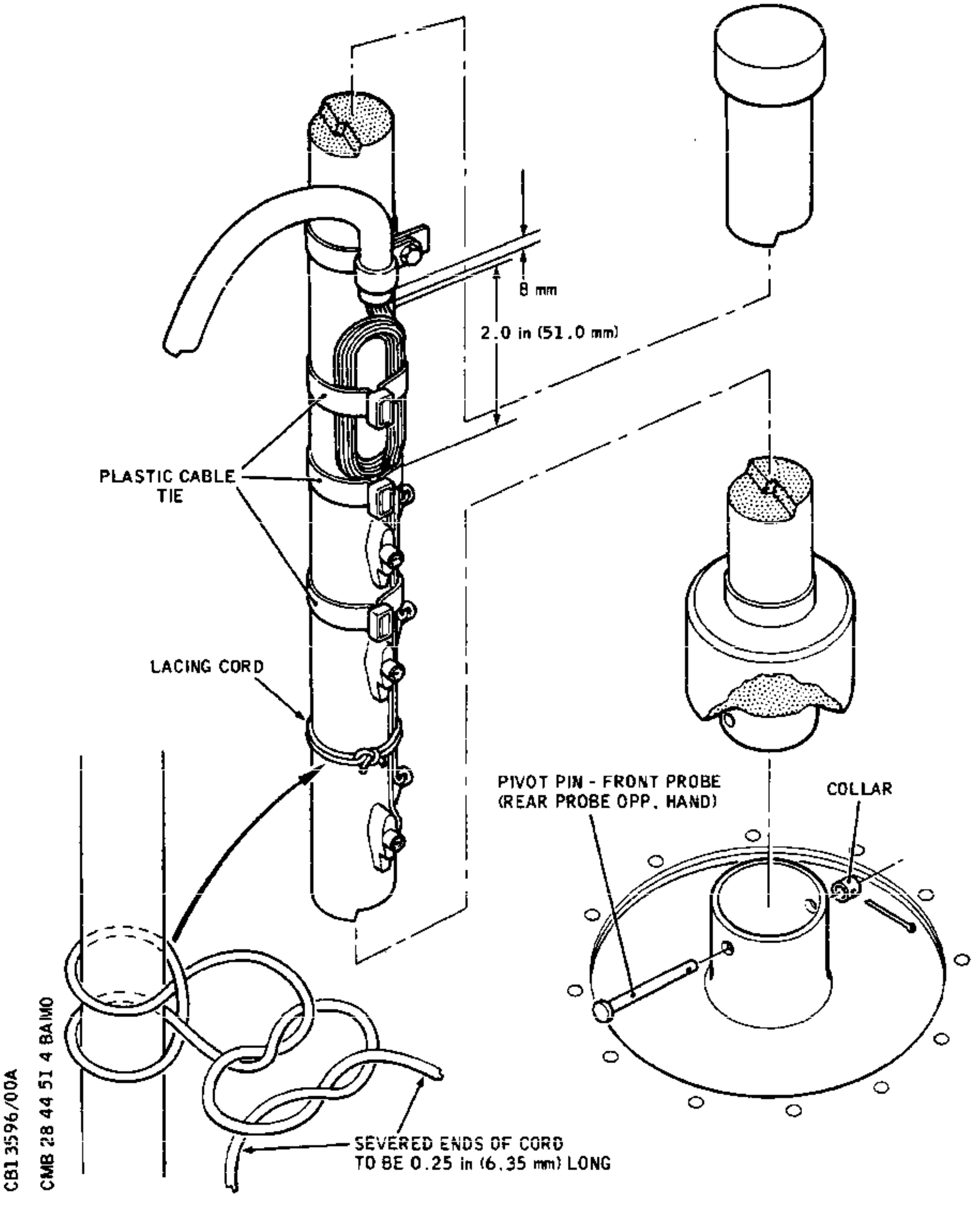
(6) Sever the ends of the plastic cable ties to permit the ties to spring clear of the probe; discard the ties.

(7) Remove the bolt retaining the conduit P-clip, and lay the harness to one side.

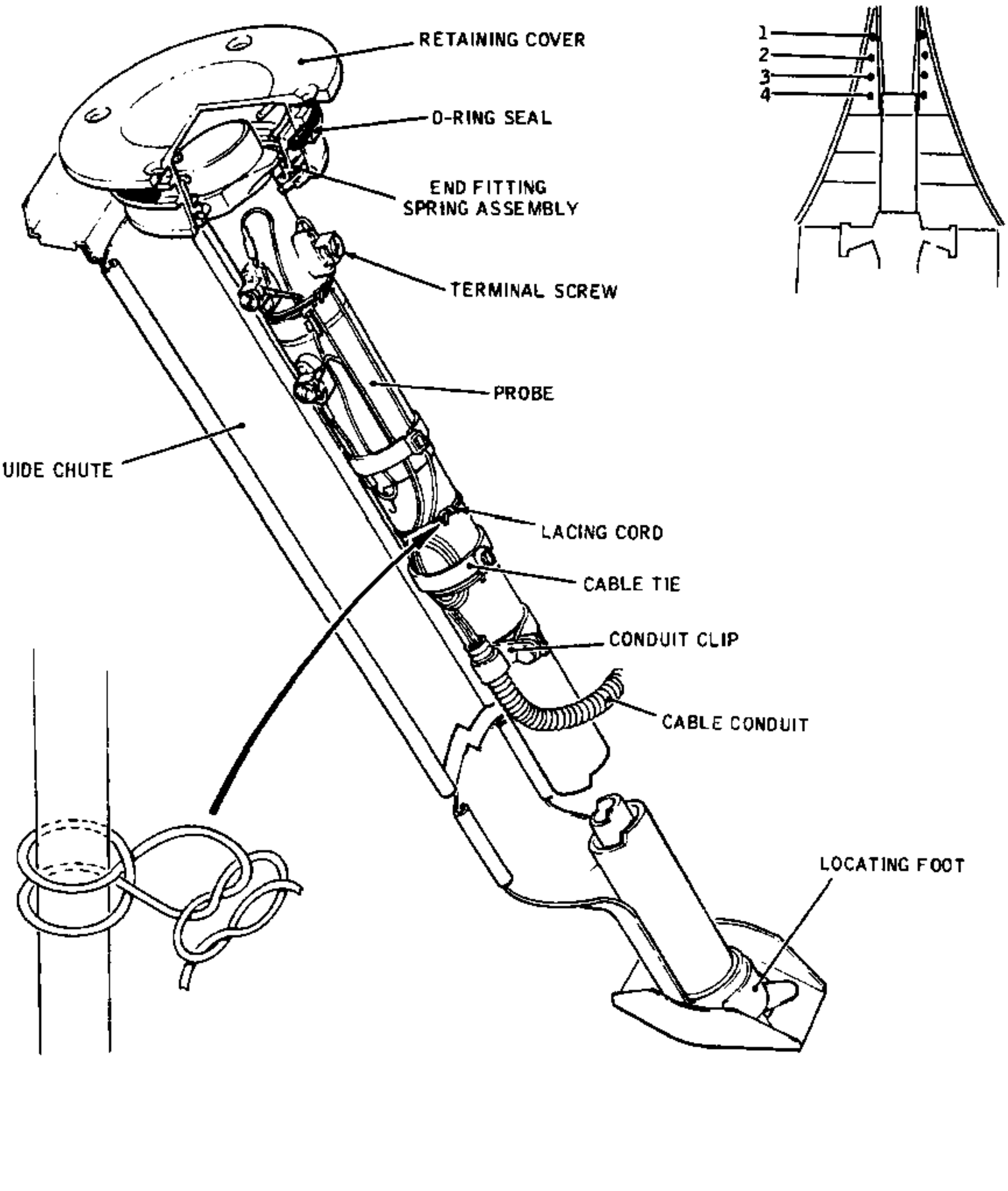
(8) Disengage the open end of the probe clamp from the



\- Fuselage Cell Probes - Installation
Figure 401



Fuselage Cell Probe Installation Details
Figure 402



- Wing Cell Probes 1 to 4 - Typical Installation
Figure 403

guide spring.

(9) With the probe angled toward the tank floor, slide the probe out, manoeuvring the clamp out through the aperture.

(10) Remove the split pin and collar, then withdraw the pivot pin to disconnect the probe from the retaining cover.

(11) Note the orientation of the probe clamp (left or right) for the front or rear probe in relation to the pivot pin, then remove the clamp, and retain it for subsequent fitting to the replacement probe.

D. Prepare to Install Fuselage Cell Probe

(1) Examine the contacting surface of the retaining cover and, if necessary, restore the Alocrom 1200 finish in accordance with 20-24-32.

(2) Install the probe clamp on the probe in line with the pivot pin hole (Ref. Fig. 402), with the open end facing left (front probe) or right (rear probe), and the centre line of the clamp 2.5 in (63.5 mm) from the top face of the probe; secure it with the clamp screw.

(3) Attach the retaining cover to the probe with the pivot pin inserted from the front for the front probe and from the rear for the rear probe; secure the pin with the collar and split pin.

(4) Ensure that the extension on the cover is correctly positioned in relation to its mating recess in the tank access door (front or rear probe) to determine the correct location of the probe in the tank; the extension must agree with the clamp position and probe terminals as illustrated (Ref. Fig. 401).

E. Install Fuselage Cell Probe (Ref. Fig. 402)

(1) Comply with the electrical safety precautions.

(2) With the probe held at an angle to the tank floor, pass the clamp through the aperture into the tank, and follow with the probe end, far enough for the electrical cables to be connected.

(3) Secure the cable conduit to the probe with the conduit P-clip; ensure that the clip is positioned correctly,

with 8 mm of conduit protruding.

NOTE: The clip must be in the correct position, to ensure that the predetermined amount of slack cable is maintained for probe installation.

(4) Secure the cable terminations to the terminals, in accordance with the Wiring Diagram Manual, 20-42-49, ensuring that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(5) With the cable routed along the probe without twists or kinks, commence at the lower end, and secure the first run of cables between the lower two terminals with a turn of lacing cord secured with a clove-hitch and a reef knot. Cut off any spare cord 0.25 in (6.35 mm) from the knot; do not damage the cable or insulation.

(6) Secure the runs of cable above and below the upper terminals, with plastic cable ties equidistantly spaced and fastened in accordance with the Wiring Diagram Manual, 20-41-09.

(7) Make a coil of any spare cable, approximately the width of the probe, and 2.0 in (51 mm) longitudinal diameter, and secure the coil flat against the probe with a plastic cable tie in accordance with the Wiring Diagram Manual, 20-41-09.

(8) Make a final check of the cable and conduit for security of attachment.

(9) Check that the contacting surfaces of the probe retaining cover and the tank aperture are clean and free from paint or contaminants.

(10) Install a new face seal in the retaining cover groove in accordance with 20-22-21.

(11) Loop the free end of the probe clamp over the guide spring; ensure that the spring is correctly engaged in the clamp, by exerting a light sideways pressure.

(12) Pass the probe into the tank and engage the top (free end) in the cap of the spring end fitting assembly.

CAUTION: IF ANY UNDUE RESISTANCE IS FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY, AND INVESTIGATE.

(13) Press the retaining cover fully home and secure it with the bolts; torque-tighten the bolts to between 50 and 60 lbf in (0.565 and 0.678 mdaN).

(14) Check that the electrical bonding is in accordance with 20-27-11.

F. Remove Wing Cell Probe (Ref. Fig. 403, 404 and 405) (Ref. Fig. 406)

NOTE: Due to the angular installation of probes 1 to 4, guide chutes are provided; a receptacle is installed on the tank floor at the No.5 probe position to guide the probe into its correct location.

With the exception of probes Q1132 and Q1139 (No.2 position), which provide mountings for high level and overfull level sensors, the wiring characteristics of all the probes are similar.

The following removal/installation procedure is applicable to a probe in either the left or the right cell.

(1) Refer to Table 401 to identify the probe to be removed. The probes are identified front to rear, left cell and right cell.

PROBE LOCATION	PROBE IDENT. LEFT CELL	PROBE IDENT. RIGHT CELL
1	Q1109	Q1096
2	Q1132	Q1139
3	Q1110	Q1097
4	Q1133	Q1138
5	Q1111	Q1098

Probe Identification
Table 401

NOTE: Before a probe is removed, the position of the retaining cover in relation to the

surrounding structure should be noted, to aid installation.

(2) Unscrew the securing bolts as far as necessary to disengage the threads, then ease the retaining cover from the tank, together with the bolts and O-ring seals, sufficiently to check that the fuel level is below the level of the access hole; if necessary defuel the tank further. When the fuel level is satisfactory, withdraw the probe far enough to note the position of the axes of the pivot pins and locating lug (Ref. Fig. 406) in relation to the retaining cover, to facilitate subsequent installation.

(3) Probes 1 to 4: using the guide chute as a support, withdraw the probe as far as the electrical conduit will permit.

(4) Probe 5: withdraw the probe from its locating foot and receptacle as far as the electrical conduit will permit.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

(5) Loosen the terminal screws and withdraw the cable terminations.

CAUTION: USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN THE LACING CORD AND PLASTIC TIES ARE SEVERED.

(6) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knot securing the lacing cord; remove and discard the cord.

(7) Sever the ends of the plastic cable ties to permit the ties to spring clear of the probe; discard the ties.

(8) Remove the bolt retaining the conduit P-clip, and lay the harness to one side.

(9) Withdraw the probe completely from the tank and fit a suitable blank to the access hole, with the harness adequately protected and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(10) With the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:-

(a) Note the orientation of the securing bolts (as one bolt is used for electrical bonding purposes), then remove the O-ring seals and the bolts; discard the seals.

(b) Compress the spring and remove the slider retaining ring.

(c) Gradually release the spring tension and withdraw the probe and slider assembly from the retaining cover; remove the spring.

(d) Remove the pivot pin retaining ring.

(e) Support the slider and withdraw the pivot pins (the pins are provided with an internal UNC3B thread for extraction purposes).

(f) Remove and discard the O-ring seal from the retaining cover.

G. Prepare to Install Wing Cell Probe

(1) Inspect the retaining cover and ensure that it is free from damage and corrosion, and that the paint finish is intact.

(2) With the probe supported in a suitable clamp, assemble the spring cap assembly as follows:-

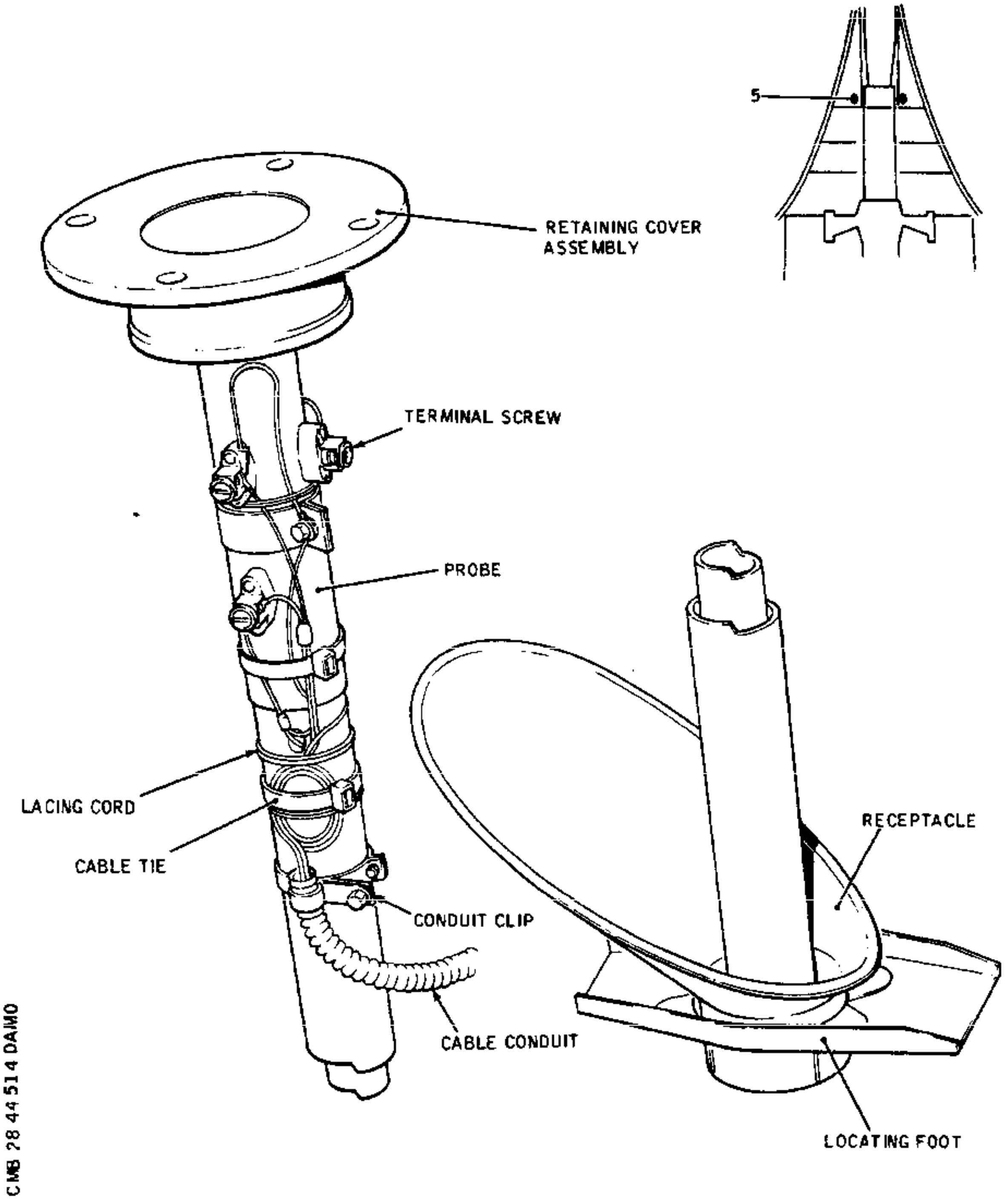
(a) Install a new O-ring seal in its groove in the retaining cover.

(b) (Ref. Fig. 404) With the slider positioned correctly on the top of the probe (with the locating lugs aligned) insert the pivot pins and install the pivot pin retaining ring.

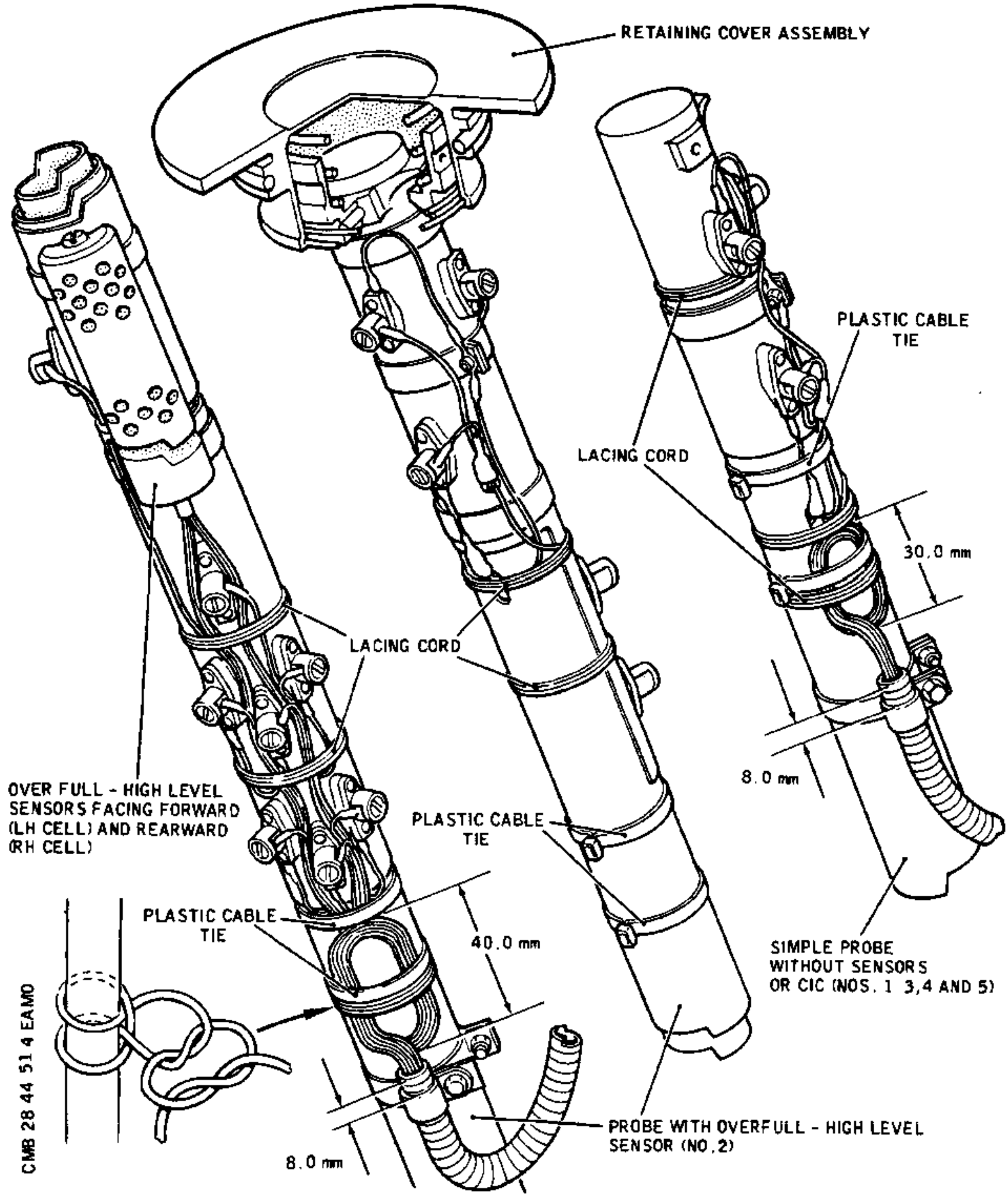
(c) Insert the spring in the retaining cover.

(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed.

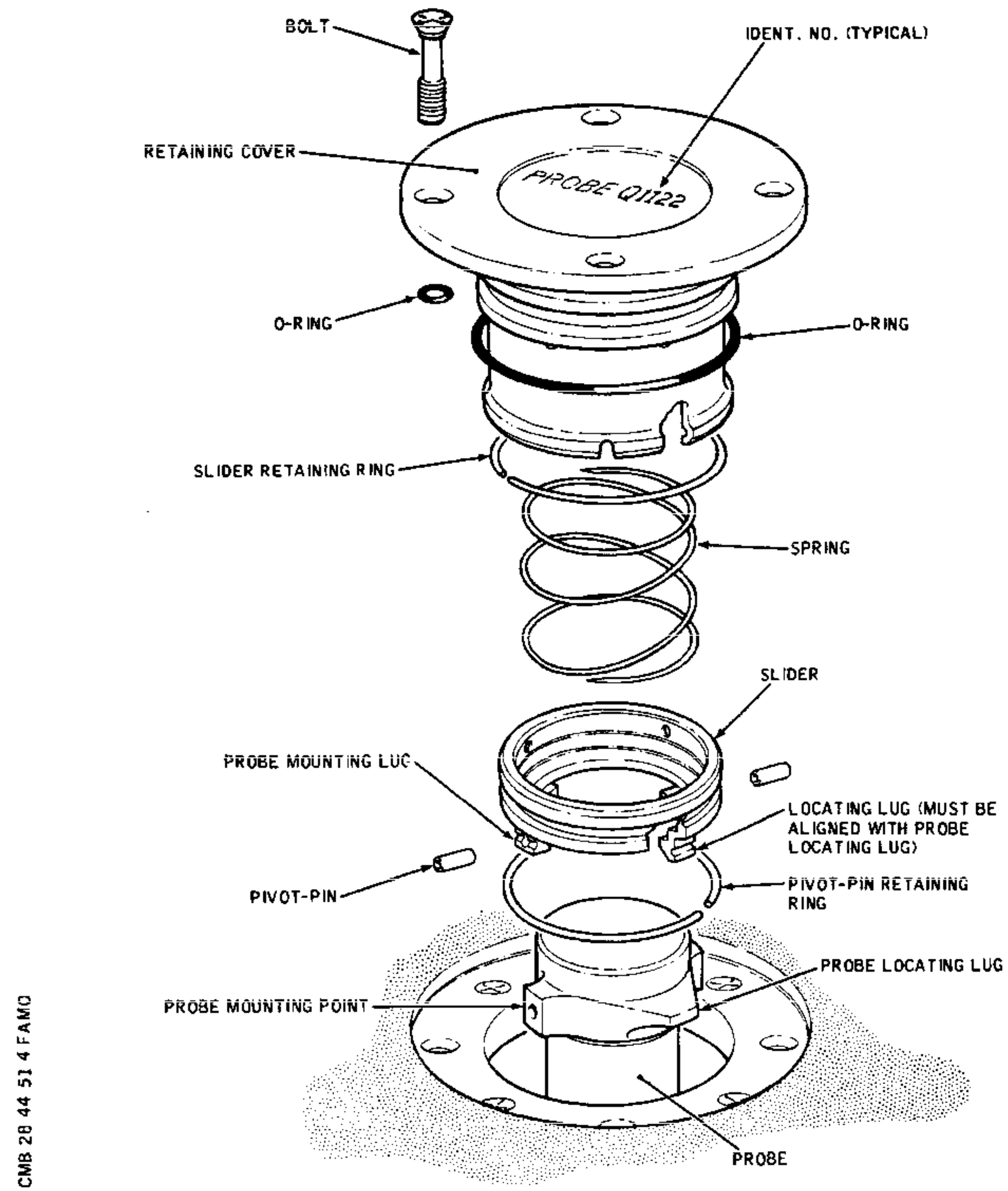
(e) With the retaining ring in position, gradually



Wing Cell Probe 5 - Installation
Figure 404



\- Wing Cell Probe Wiring Installation Details
Figure 405



- Typical Wing Cell Probe Retaining Cover
Figure 406

release the tension on the spring.

(f) Refer to paragraph G.(7).(a), then install the bolts in their correct locations, together with the O-ring seals.

H. Install Wing Cell Probe (Ref. Fig. 403, 404 and 405)

(1) Comply with the electrical safety precautions.

(2) With the centre line of the conduit clip 8.25 in (210 mm) (probes 1, 3, 4 and 5) or 15.00 in (380 mm) (probe 2), as applicable, from the top of the probe, secure the cable conduit to the probe with 8 mm of conduit protruding.

NOTE: The conduit clip must be positioned correctly, to ensure that the predetermined length of slack cable is maintained for probe installation.

(3) With the cable routed along the probe, without twists or kinks, secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49, ensuring that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(4) Make a coil of spare cable of approximate probe width, and with a longitudinal diameter of approximately 30 mm for probes 1, 3, 4 and 5 and 40 mm for probe 2, and secure the coil with a length of lacing cord and a plastic cable tie.

(5) Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09; secure the lacing cord with a clove hitch and a reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(6) Refer to paragraph (4) and secure the remaining cable to the probe, with plastic ties and lacing cord as appropriate.

NOTE: To complete the installation satisfactorily, the probe must be positioned correctly in the tank in relation to the guide chute (probes 1, 2, 3 and 4) or the receptacle (probe 5) as appropriate, and the retaining cover.

(7) Refer to paragraph G.(3) and preceding NOTE, then rotate the probe as necessary in the retaining cover until the locating lug at the top of the probe is positioned at 180 deg to the centre line of the guide chute or receptacle and the pivot pins are parallel with the guide chute.

(8) For probes 1, 2, 3 and 4: slide the probe carefully along the guide chute until the base of the probe engages the locating foot.

(9) For probe 5: lower the probe until it engages the offset receptacle, which will then guide the bottom of the probe into its correct location.

RB CAUTION: IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
RB POSITIONED IN LOCATING FOOT, THEN VISUALLY
RB VERIFY BY EITHER REMOVING AN ADJACENT FUEL
RB TANK ACCESS PANEL OR DEFUELLING AND ENTERING
RB THE APPROPRIATE FUEL TANK (REF. 28-25-00).
RB FAILURE TO LOCATE PROBES CORRECTLY CAN RESULT
RB IN STRUCTURAL DAMAGE TO FUEL TANK WALLS.

NOTE: If no spring resistance is felt, the probe is not located correctly in its receptacle, and must be removed and re-inserted.

(10) Rotate the retaining cover, if necessary, until, when pressed down by hand against the spring, it seats flat into the recess in the wing.

(11) Secure the retaining cover with the securing bolts, then torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(12) Check that the electrical bonding is in accordance with 20-27-11.

I. Conclusion

(1) Reset the circuit breakers tripped before probe removal.

(2) Refuel the tank as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(3) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test.

(4) Remove all tools and equipment from the area.

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PROBES, TANK 10 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

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1. General (Ref. Fig.401, 402 and 403) (Ref. Fig.404 and 405)

The probe installations for individual probes in both No.10 tank wing cells (LH and RH) are similar, with all the probes being accessible from the wing top surface. However, due to the wing profile, it may be necessary to partially defuel a cell for probe removal.

The centre (No.2) probe of the three installed in each cell carries a dual high level-overfull level sensor assembly. Because of the angle of the probes, guide chutes are provided to facilitate probe installation.

The fuselage cell is located between the wing cells and probes in this cell are installed in canisters. These probes are accessible from the fuselage bottom surface.

All electrical connections to the probes are internal, but are made with the probes partially removed from the tanks.

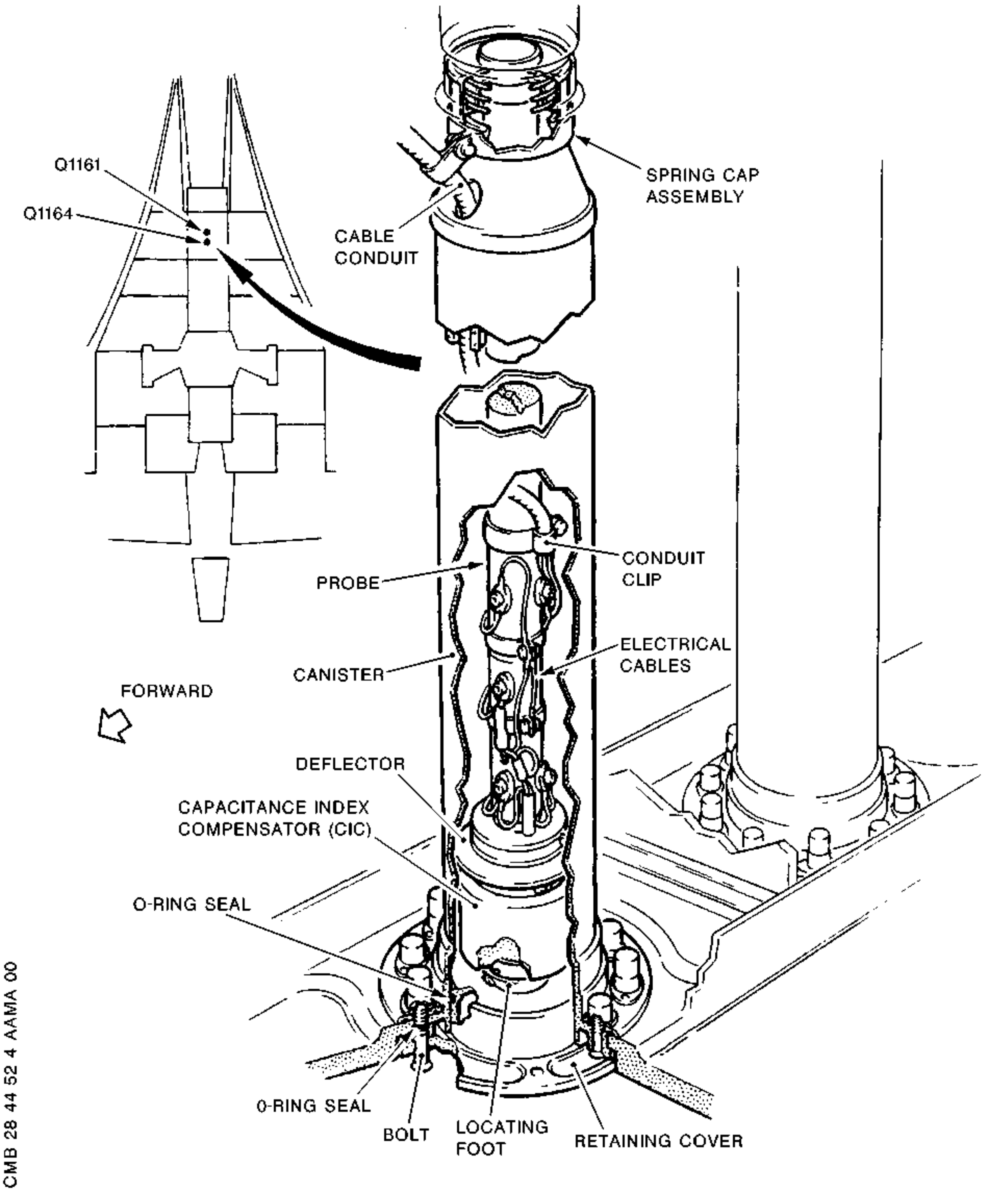
**ON A/C 001-006,

B NOTE: F.Q.I. Probe Connections

B It is imperative that the tightening methods laid down in
B the Maintenance Manual are adhered to.

B Physically check the cable terminations for movement to
B ensure that it is effectively clamped.

The following procedure deals separately with the fuselage cell and wing cell probes, but the 'Equipment and Materials', 'Prepare to Remove Probe' and 'Conclusion' paragraphs are applicable to both types of probe.



Fuselage Cell Probe - Installation
Figure 401 (Sheet 1 of 2)

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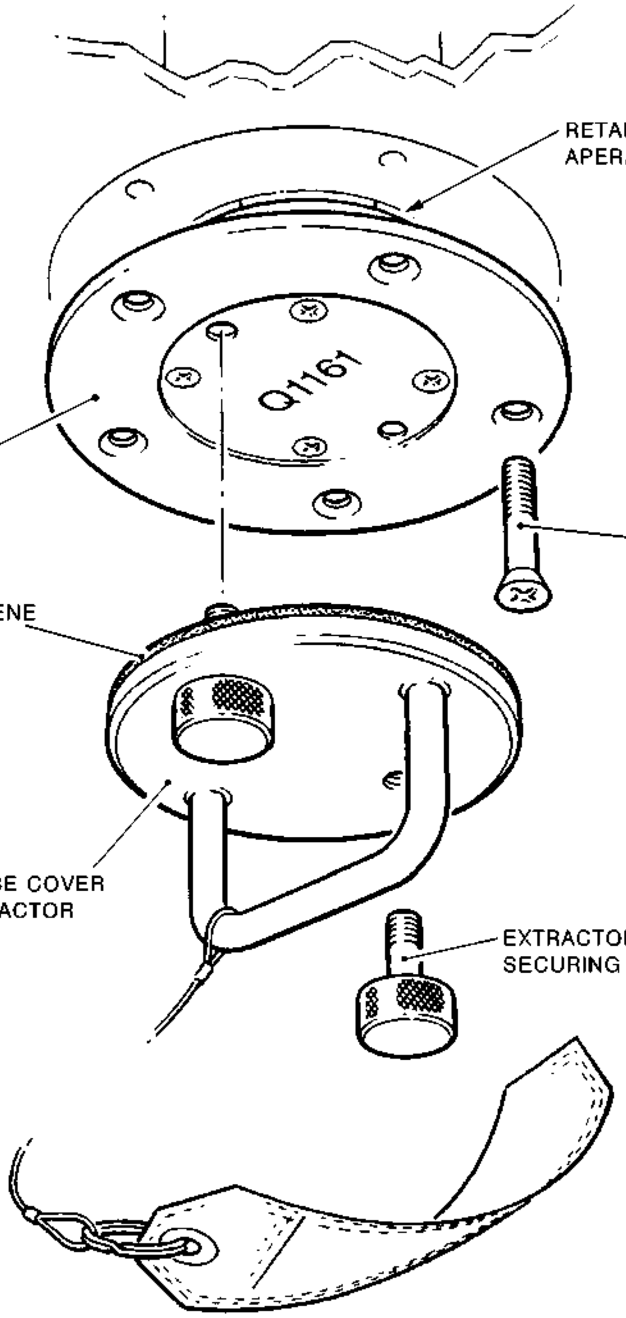

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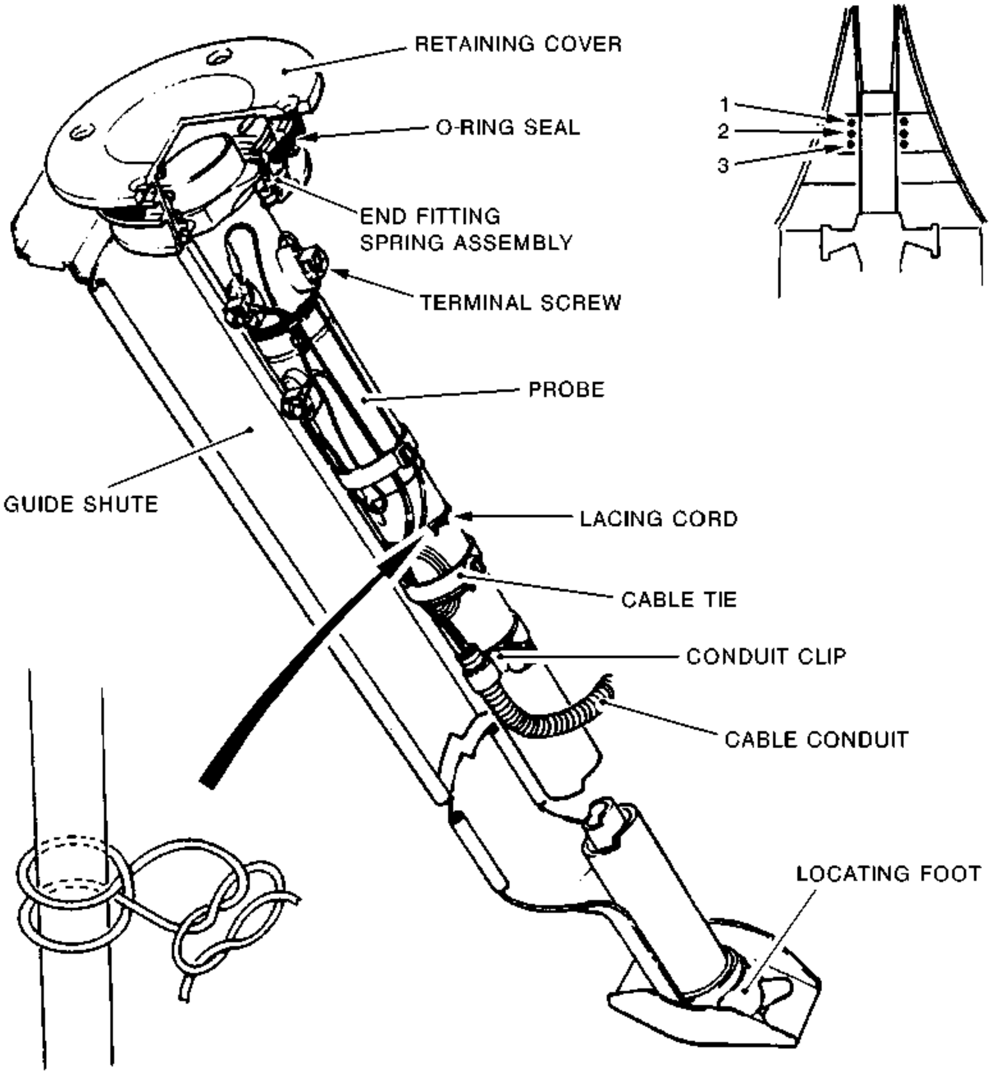
Fuselage Cell, Probe Cover Extractor - Installation
Figure 401 (Sheet 2 of 2)



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Typical Wing Cell Probe - Installation
Figure 402

2. Probes

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
Fuel gauge probe cover extractor	D925259000

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B. Prepare to Remove Probe

NOTE: Because of the wing profile, it may be necessary to empty the tank partially for probe removal.

(1) Partially empty the tank as necessary, consistent with the probe location, by transferring fuel as detailed in 28-23-00, or defuelling as detailed in 28-25-00.

(2) Ensure that the ground refuel panel 1-194 is closed.

(3) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switch is inadvertently operated.

(4) Isolate the electrical supplies to the probes by tripping the appropriate circuit breakers, including breakers Q1217, Q1218 and Q1219 for the wing cells only. Fit safety clips.

NOTE: To obviate the possibility of inadvertent removal of a probe with power supplies connected to channel A or B, both channels are isolated, irrespective of the probe location.

A small screwed plug may be located on the forward segment of the fuselage cell probe retaining cover. This plug can be used to drain residual fuel, but otherwise should be ignored.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 9, 10, 11 FQI CH B & 3CM CG IND SUP	4-213	Q1356	B 1
TANKS 9, 10, 11 FQI CH A & PLTS CG IND SUP	2-213	Q1358	A18
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F 8
LH TANKS & TANK 10 HIGH LEVEL SUP	15-215	Q1218	D19
O/FULL SUP & IND	3-213	Q1219	D 5

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C. Remove Fuselage Cell Probe (Ref. Fig.401 and 403)

NOTE: Due to the restricted length of the free conduit between the tank harness and the probe, two operators may be required to perform the necessary disconnection operations for final probe removal.

(1) Identify the probe to be removed by referring to the equipment identification number engraved on the retaining cover, Q1161 front and Q1164 rear.

(2) Loosen and partially unscrew the ring of securing bolts. Keep the retaining cover pressed upward, to guard against the possibility of the pre-load spring at the opposite end of the probe forcing the probe and cover out of the tank, then remove the bolts together with their individual O-ring seals. Note the position of the bolts, as one bolt is used for bonding purposes.

(3) Ensure that the extractor neoprene facing seal is undamaged and bonded correctly, then secure the extractor to the retaining cover with the special bolts.

(4) Position a suitable container to catch any residual fuel, then, allowing for the spring force of the end fitting spring assembly, ease the cover away from the tank. When the cover is withdrawn approximately 0.75 in (20 mm), hold the cover with the free hand and be ready to support the probe as the cover is removed completely from the tank.

(5) Disengage the probe from the locating cup in the retaining cover and remove the cover.

NOTE: A cable conduit is secured to the probe by a series of fixing collars. The lower of the upper pair of collars is also used as an anchorage for a restraining cord. This restraining cord is fitted with a metal loop for attachment to the tank structure, by means of a canister securing bolt, to support the probe during the wiring and fixing collar disassembly/assembly operations.

(6) Withdraw the probe carefully to reveal the upper pair of conduit fixing collars and identify the nylon restraining cord.

CAUTION: USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN SEVERING THE PLASTIC CABLE TIES AND LACING CORD.

(7) Using end- or side-cutters, with the blades held flat against the probe, sever the knots securing the lacing cord, to free the restraining cord.

(8) Remove an adjacent bolt from the ring securing the probe canister, then use the same bolt to fasten the metal loop on the end of the restraining cord to the tank structure. If necessary, loosen the collar clamping bolt to permit the cord to position itself without kinking.

(9) Check that the probe is held securely before proceeding with the wiring disassembly.

(10) Loosen the terminal screws and withdraw the cable terminations.

(11) Refer to operation (7) and sever the remaining lacing cords, which retain the electrical cables.

(12) Sever the ends of the plastic cable ties and discard the ties.

(13) Release the collars securing the cable conduit to the probe, with the exception of the collar to which the restraining cord is attached.

(14) Support the probe and release the final collar, then carefully withdraw the probe from the tank, leaving the conduit supported by the restraining cord.

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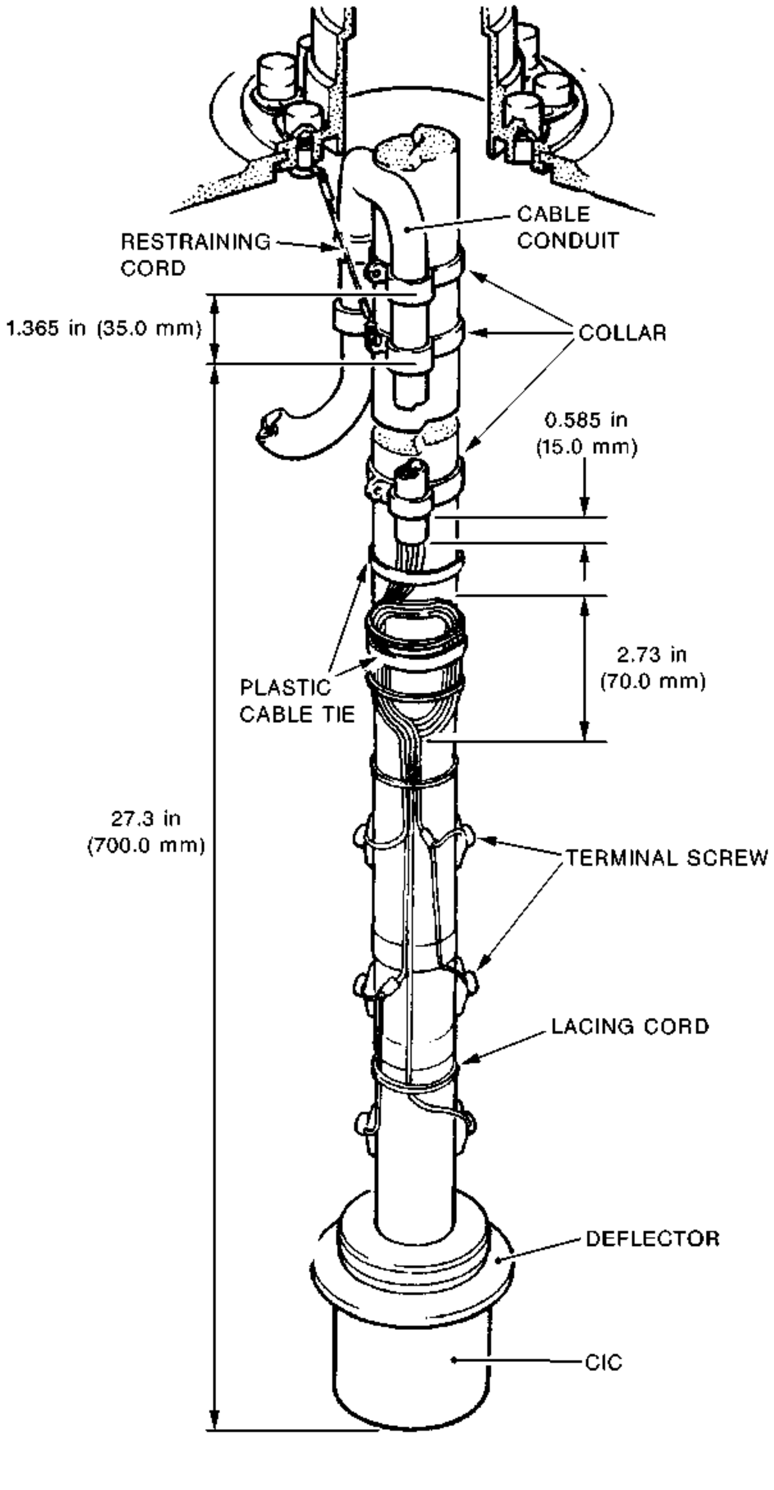

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Fuselage Cell Probe Wiring Installation
Figure 403

(15) With the restraining cord still attached to the tank structure, stow the spare conduit and cable inside the canister, to prevent damage occurring.

D. Prepare to Install Fuselage Cell Probe

(1) Check that the contacting surfaces of the retaining cover and the support canister are clean and free from contamination, damage and corrosion, and that the finish is intact.

(2) Install a new O-ring seal in the groove on the body of the retaining cover. Lubricate the seal with clean, approved system fuel.

(3) Discard the existing O-ring seals on the securing bolts and install new seals. Do not change the position of the bolts as one is used for electrical bonding purposes.

(4) Inspect the electrical cables and terminations, and repair as necessary in accordance with the Wiring Diagram Manual, 20-42-49.

E. Install Fuselage Cell Probe (Ref. Fig.401 and 403)

(1) Comply with the fuel and electrical safety precautions.

(2) Pass the probe partly into the tank, then measure 27.3 in (700.00 mm) from the base of the probe and temporarily install the lower of the top pair of conduit retaining collars.

(3) Secure the collar to the probe, with the conduit routed as shown in the appropriate figure, to ensure that the cable lead to the terminals at the correct angle.

(4) Ensure that the restraining cord is securely attached to the tank and that the probe is held securely.

(5) Temporarily install the top conduit retaining collar 1.365 in (35.0 mm) above the collar installed in operation (2) and in the same configuration.

(6) Temporarily install the bottom collar 15.6 in (400.0 mm) from the base of the probe, with the remaining collar 5.85 in (150.00 mm) above it.

(7) With the collars temporarily installed in their correct positions on the probe, check that the conduit protrudes 0.585 in (15.0 mm) (nominal) beyond the bottom clip. Tighten all the retaining collar securing bolts.

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(8) Route the electrical cables along the probe, without twists or kinks, and secure the terminations to the screw terminals in accordance with the Wiring Diagram Manual, 20-42-49, ensuring that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(9) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of 2.73 in (70.0 mm) (nominal).

(10) In each instance secure the coil with a plastic cable tie (centrally disposed) and two lengths of lacing cord as illustrated. Secure the cable tie in accordance with the Wiring Diagram Manual 20-41-09. Secure the lacing cord with a clove hitch and a reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(11) Refer to operation (10) and secure the remaining cable to the probe with a plastic cable tie, 1.17 in (30.0 mm) (nominal) below the bottom conduit retaining collar, and lacing cord, as appropriate.

(12) Check that the retaining cover securing bolts are positioned correctly, and that new O-ring seals are assembled on them. Check that the O-ring seal is in place in its groove in the retaining cover, then lubricate all the seals with approved system fuel.

(13) Support the probe and remove the bolt used to secure the restraining cord to the tank structure. Replace the bolt and torque-tighten it to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(14) Secure the restraining cord to the probe with two lengths of lacing cord as detailed in operation (10).

(15) Make a final check of the conduit and cable for security of attachment.

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(16) Slide the probe fully home, taking care not to kink or damage the cables, and hold it in position.

CAUTION: IF UNDUE RESISTANCE IS FELT, WITHDRAW THE PROBE AS FAR AS NECESSARY AND INVESTIGATE THE CAUSE.

B IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
B POSITIONED IN LOCATING FOOT, THEN VISUALLY
B VERIFY BY EITHER REMOVING AN ADJACENT FUEL TANK
B ACCESS PANEL OR DEFUELLING AND ENTERING THE
B APPROPRIATE FUEL TANK (REF. MM 28-25-00).
B FAILURE TO LOCATE PROBES CORRECTLY CAN RESULT IN
B STRUCTURAL DAMAGE TO FUEL TANK WALLS.

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NOTE: The retaining cover bolt holes are offset to assist installation.

(17) Push the cover fully home and secure it with the bolts. Ensure that the earthing bolt is positioned correctly, as noted in operation (12). Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(18) Check that the electrical bonding is in accordance with 20-27-11.

F. Remove Wing Cell Probes (Ref. Fig.402, 404 and 405)

NOTE: Due to the angular installation of the wing probes, guide chutes are provided.

With the exception of probes Q1163 and Q1162 (No.2 position), which provide mounting for high level and overfull lever sensors, the wiring characteristics of all the probes are similar.

The following removal/installation procedure is applicable to a probe in either the left or the right cell.

(1) Refer to Table 401 to identify the probe to be removed. The probes are identified front to rear, left cell and right cell.

PROBE LOCATION	PROBE IDENT. LEFT CELL	PROBE IDENT. RIGHT CELL
1	Q1159	Q1165
2	Q1163	Q1162
3	Q1160	Q1166

Probe Identification
Table 401

NOTE: Before a probe is removed, the position of the retaining cover in relation to the surrounding structure should be noted, to aid installation.

(2) Identify the securing bolts before removal, as one bolt is used for electrical bonding purposes, then unscrew the bolts and ease the retaining cover from the tank sufficiently to check that the fuel level is below the level of the access hole. If necessary defuel (Ref. 28-25-00) the tank further, or transfer fuel as detailed in 28-23-00.

(3) When the fuel level is satisfactory, withdraw the probe far enough to note the axes of the pivot pins and locating lug in relation to the retaining cover, to facilitate subsequent installation.

(4) Using the guide chute as a support, withdraw the probe as far as the electrical conduit will permit.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED. ENSURE THAT NO DEBRIS ENTERS THE TANK.

(5) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord, and the ends of the plastic cable ties. Remove and discard the lacing cord and the cable ties.

(6) Remove the conduit securing clip.

(7) Uncoil the spare cable and withdraw the probe from the tank.

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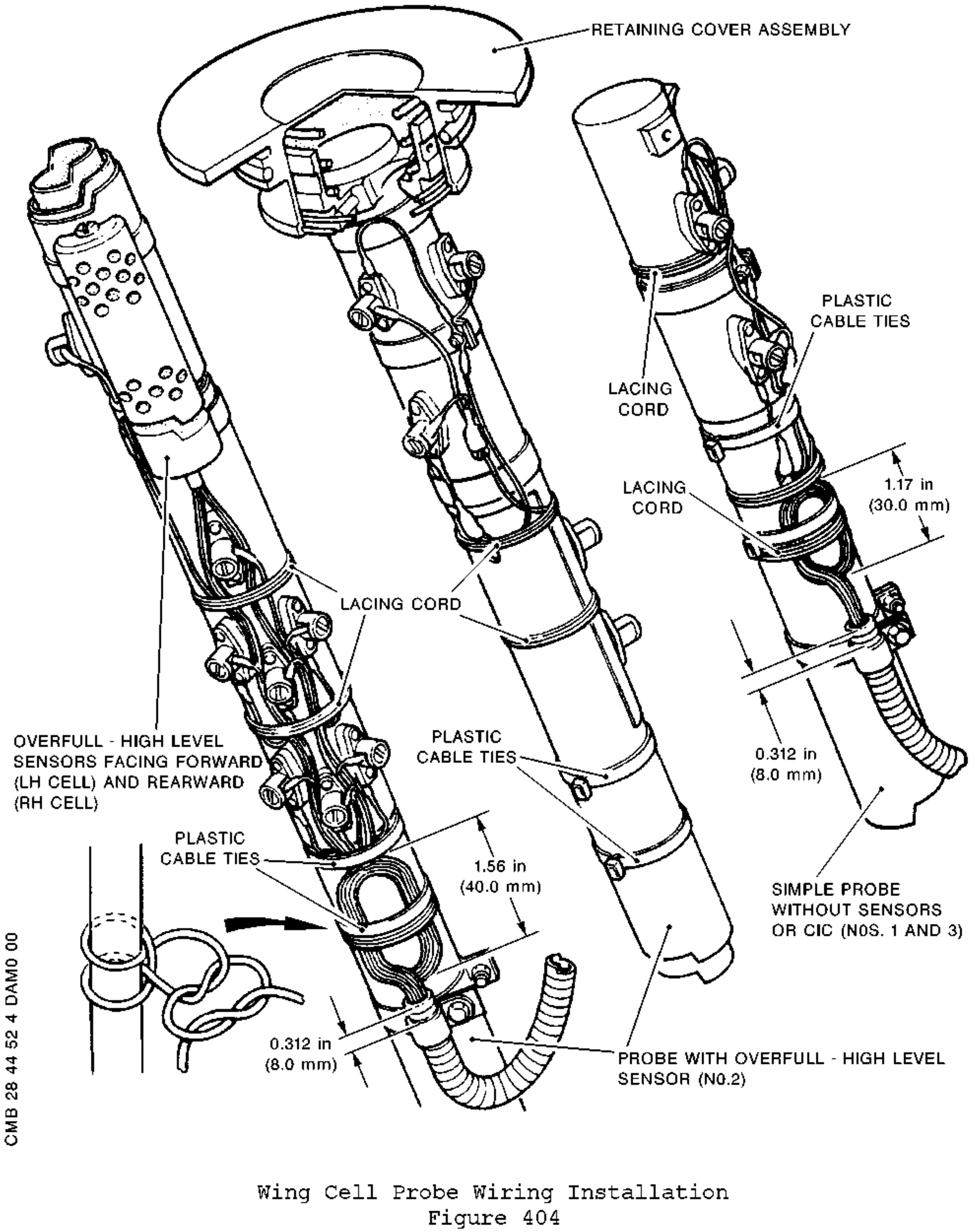
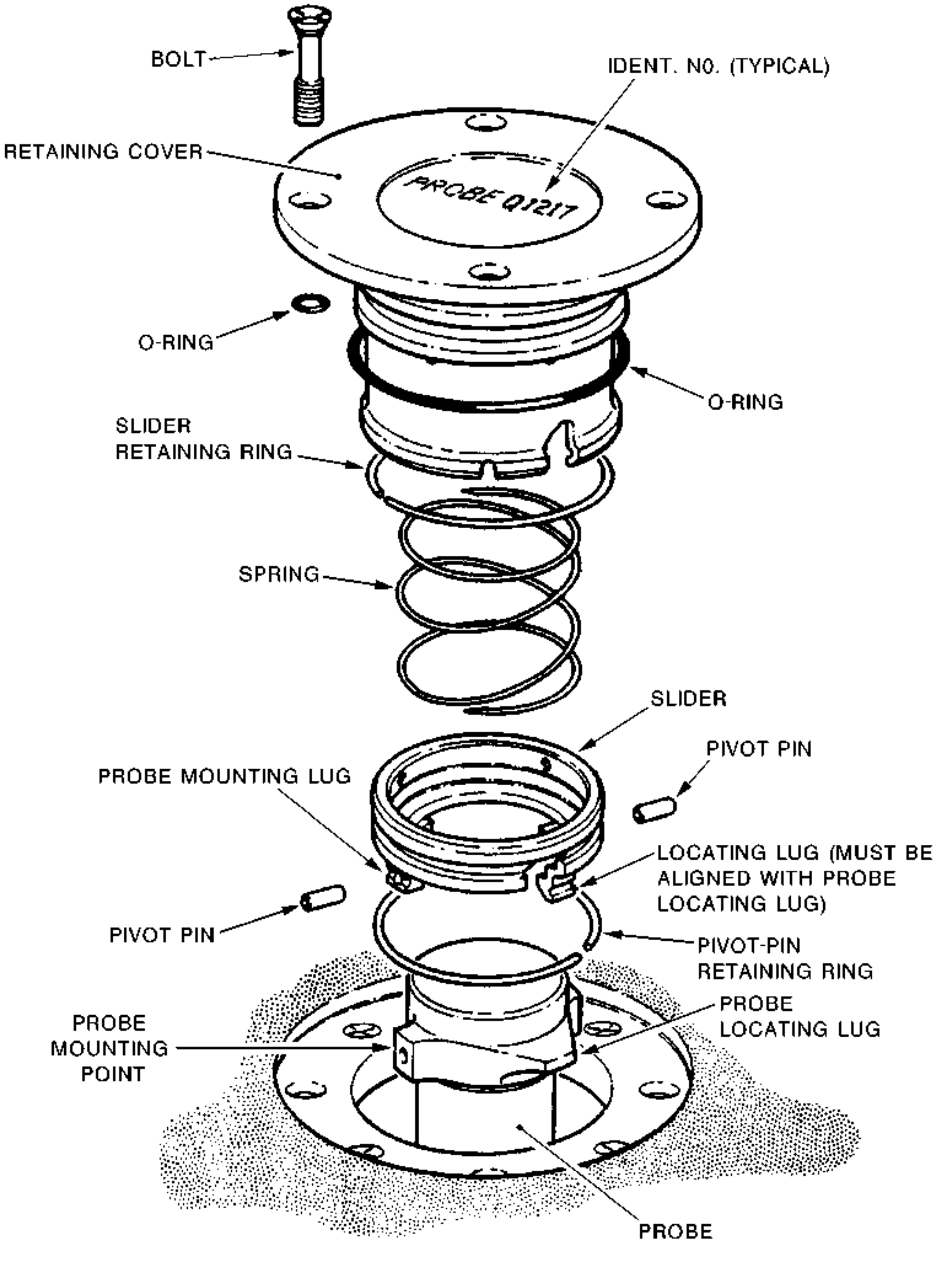


Wing Cell Probe Wiring Installation
Figure 404



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Typical Wing Cell Probe Retaining Cover
Figure 405

(8) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(9) Withdraw the probe completely from the tank and fit a suitable blank to the access hole, with the harness adequately protected, and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OR THE RETAINING COVER.

(10) With the probe supported in a suitable clamp, disassemble the spring cap assembly as follows:

(a) Compress the spring and remove the slider retaining ring.

(b) Gradually release the spring tension and withdraw the probe and slider assembly from the retaining cover. Remove the spring.

(c) Remove the pivot-pin retaining ring.

(d) Support the slider and withdraw the pivot pins.

NOTE: The pins are provided with an internal UNC 3B thread for extraction purposes.

(e) Remove and discard the O-ring seal from the retaining cover, and each securing bolt.

G. Prepare to Install Wing Cell Probe (Ref. Fig.405)

(1) Inspect the retaining cover and ensure that it is free from damage and corrosion, and that the paint finish in intact.

(2) With the probe supported in a suitable clamp, assemble the spring cap assembly as follows:

(a) Install a new O-ring seal in its groove in the retaining cover. Install a new O-ring seal on each securing bolt. Lubricate the seals with clean, approved system fuel.

(b) With the slider positioned correctly on the top of the probe (with the locating lugs aligned), insert the pivot-pins and install the pivot-pin retaining ring.

(c) Insert the spring in the retaining cover.

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(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed.

(e) With the slider retaining ring in position, gradually release the compression of the spring.

H. Install Wing Cell Probe (Ref. Fig.402, 404 and 405)

(1) Comply with the fuel and electrical safety precautions.

(2) Secure the cable conduit to the probe with the conduit clip. Check that 0.312 in (8.0 mm) (nominal) of conduit protrudes beyond the clip.

(3) With the cable routed along the probe, without twists or kinks, secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(4) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of approximately 1.17 in (30.0 mm) for probes 1 and 3, and 1.56 in (40.0 mm) for probe 2. Secure the coil with a length of lacing cord and a plastic cable tie. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and a reef knot, taking care not to damage the cables or insulation.

(5) Refer to operation (4) and secure the remaining cable to the probe, with a plastic tie and lacing cord as appropriate.

B <u>CAUTION</u>: IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
B POSITIONED IN LOCATING FOOT, THEN VISUALLY VERIFY
B BY EITHER REMOVING AN ADJACENT FUEL TANK ACCESS
B PANEL OR DEFULLING AND ENTERING THE APPROPRIATE
B FUEL TANK (REF. MM 28-25-00). FAILURE TO LOCATE
B PROBES CORRECTLY CAN RESULT IN STRUCTURAL
B DAMAGE TO FUEL TANK WALLS.

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NOTE: To complete the installation satisfactorily, each probe must be positioned correctly in the tank in relation to its guide chute, and the retaining cover.

(6) Refer to operation F.(2) and preceding NOTE, then rotate the probe as necessary in the retaining cover until the locating lug at the top of the probe is positioned at 180 deg to the centre line of, and the pivot-pins are parallel with, the guide chute.

(7) Slide the probe carefully along the guide chute until the base of the probe engages the locating foot.

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(8) Rotate the retaining cover, if necessary, until, when pressed down by hand against the spring, it seats flat into the recess in the wing.

(9) Secure the retaining cover with the securing bolts, noting their correct location as determined in operation F.(2), as one bolt it utilized for electrical bonding purposes. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(10) Check that the electrical bonding is in accordance with 20-27-11.

J. Conclusion

R (1) If a fuel tank access panel was removed in the CAUTION
R preceding operations 2.E.(17) and 2.H.(6) proceed as follows:

R
R (a) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R
R NOTE: Any bonding lead which is found to be broken,
R frayed, or with braid loose in the crimp is to be replaced before the next flight.

R
R Bonding leads which show signs of surface
R corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R

(b) Refit the fuel tank access panel

R

(2) Reset the circuit breakers tripped before probe removal.

R

(3) Refuel the tank, as necessary, as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

R (4) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test. For wing cell probe 2 only, perform the appropriate section (High Level and Overfull) of the Functional Test detailed in 28-42-00, Adjustment/Test.

R (5) Remove all tools and equipment from the area. Remove the warning placard from the flight compartment.

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PROBES, TANK 11 - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General (Ref. Fig.401, 402 and 403)

Five probes are installed in tank 11 and comprise four full-length fuel quantity indication (FQI) probes in pairs, situated at the front and rear of the tank, and one short dummy probe. The four FQI probes are accessible from the fuselage top surface, left or right of the fin, through retaining covers. The dummy probe is bracket-mounted inside the tank.

In addition to its normal FQI function the left front probe carries overfull and high level sensors and a capacitance index compensator (CIC). The right front probe is fitted with a CIC. The dummy probe provides a mounting for overfull and high level sensors.

Due to the profile of the fuselage and the aircraft ground angle, the fuel level in the tank must be low enough to permit FQI probe removal without spillage, which may necessitate partial draining of the tank.

Access to the dummy probe is through a panel aperture in the bottom of the tank, and necessitates the complete draining of the tank.

**ON A/C 001-006,

B NOTE: F.Q.I. Probe Connections

B It is imperative that the tightening methods laid down in the
B Maintenance Manual are adhered to.

B Physically check the cable terminations for movement to
B ensure that it is effectively clamped.

The following procedure deals separately with the front and rear probes and the dummy probe, but the 'Equipment and Materials', 'Prepare to Remove Probe' and 'Conclusion' paragraphs are applicable to all probes.

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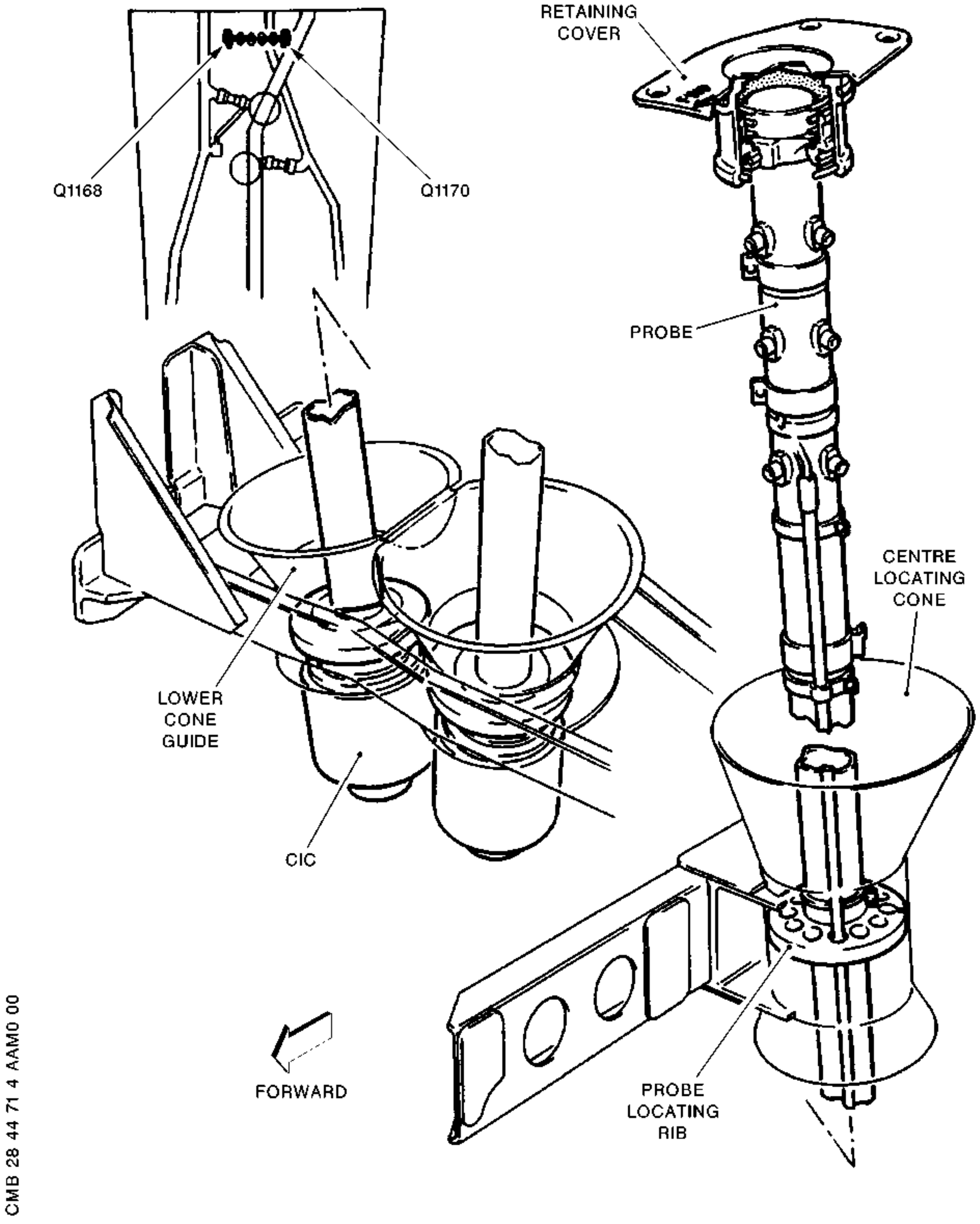

Front Probe - Installation
Figure 401

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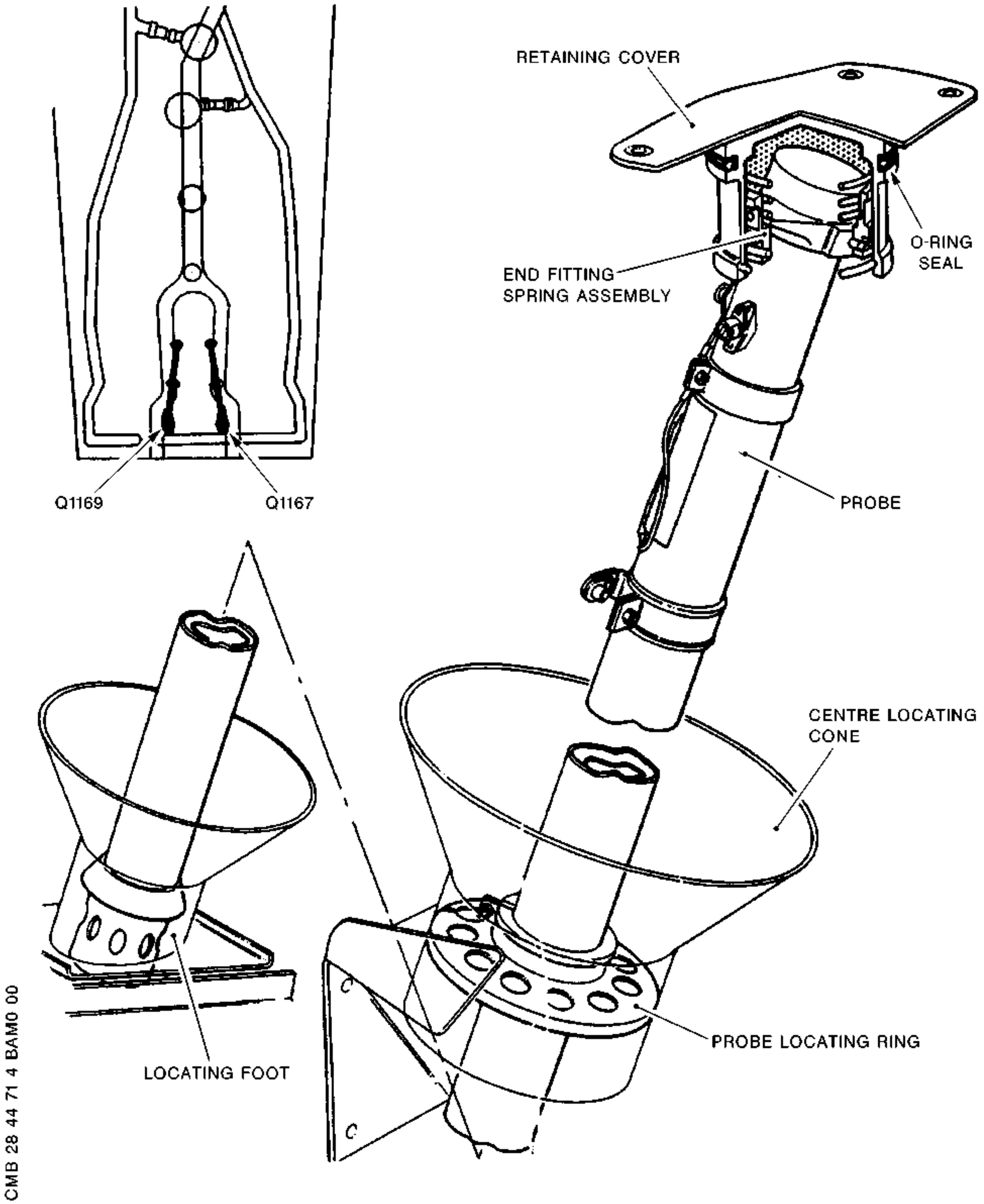
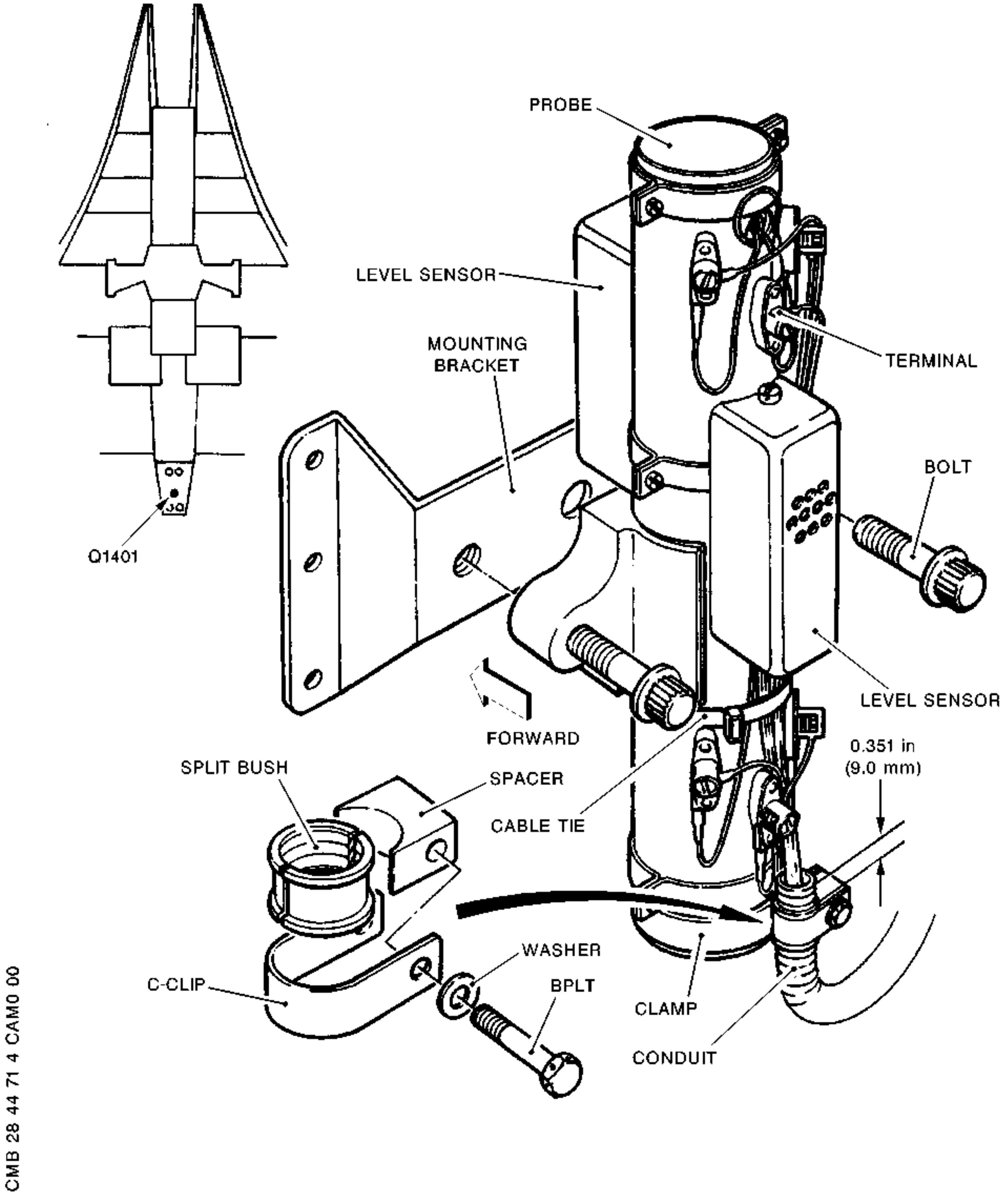


Rear Probe - Installation
Figure 402



Dummy (Centre) Probe - Installation
Figure 403

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2. Probes

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque screwdriver, 8 to 9 lbf in (0.090 to 0.102 mdaN)	-
Torque spanner, 40 to 45 lbf in (0.452 to 0.508 mdaN)	-
Torque spanner, 70 to 80 lbf in (0.791 to 0.904 mdaN)	-
PTFE tape, unsintered	BAS 8140

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B. Prepare to Remove Probe

(1) If the dummy probe is to be removed, defuel the tank as detailed in 28-25-00. Gain access by removing access panel 311 CB (Ref. 28-10-00).

(2) If a full-length probe is to be removed, drain the tank as far as necessary, consistent with the probe location in the tank, by transferring fuel as detailed in 28-23-00.

(3) Isolate the electrical supplies to the probe by tripping the circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
RH TANKS & TANK 11 HIGH LEVEL SUP	15-216	Q1217	F 8
O/F SUP & IND	3-213	Q1219	D 5
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B 1
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18

(4) Check that the fuel management panel is in the aircraft ground condition (Ref. 28-00-00, Servicing) and display a suitable warning placard to ensure that no switches are inadvertently operated.

C. Remove Front or Rear Probe (Ref. Fig.401) (Ref. Fig.402, 404 and 405)

CAUTION: HANDLE THE PROBES WITH EXTREME CARE TO AVOID DAMAGING THE PROBES OR SURROUNDING STRUCTURE.

NOTE: Due to the restricted length of the free conduit between the tank harness and the conduit retaining clip on the probe, as well as the total length of the probe (approximately 90 in (2,290 mm) front, and 77 in (1,970 mm) rear), two operators will be required to perform the necessary electrical disconnection/connection operations to effect probe removal/installation.

(1) Refer to Table 401 and identify the probe to be removed.

PROBE IDENT NO.	POSITION
Q1168	Left front
Q1170	Right front
Q1169	Left rear
Q1167	Right rear
Q1401	Dummy (centre)

Probe Identification
Table 401

(2) Unscrew the retaining bolts sufficiently to clear the threads, then ease the retaining cover, together with the bolts and O-ring seals, from the tank, far enough to check that the fuel level is below the access hole.

(3) If necessary drain the tank further, until the level is satisfactory (Ref. 28-23-00).

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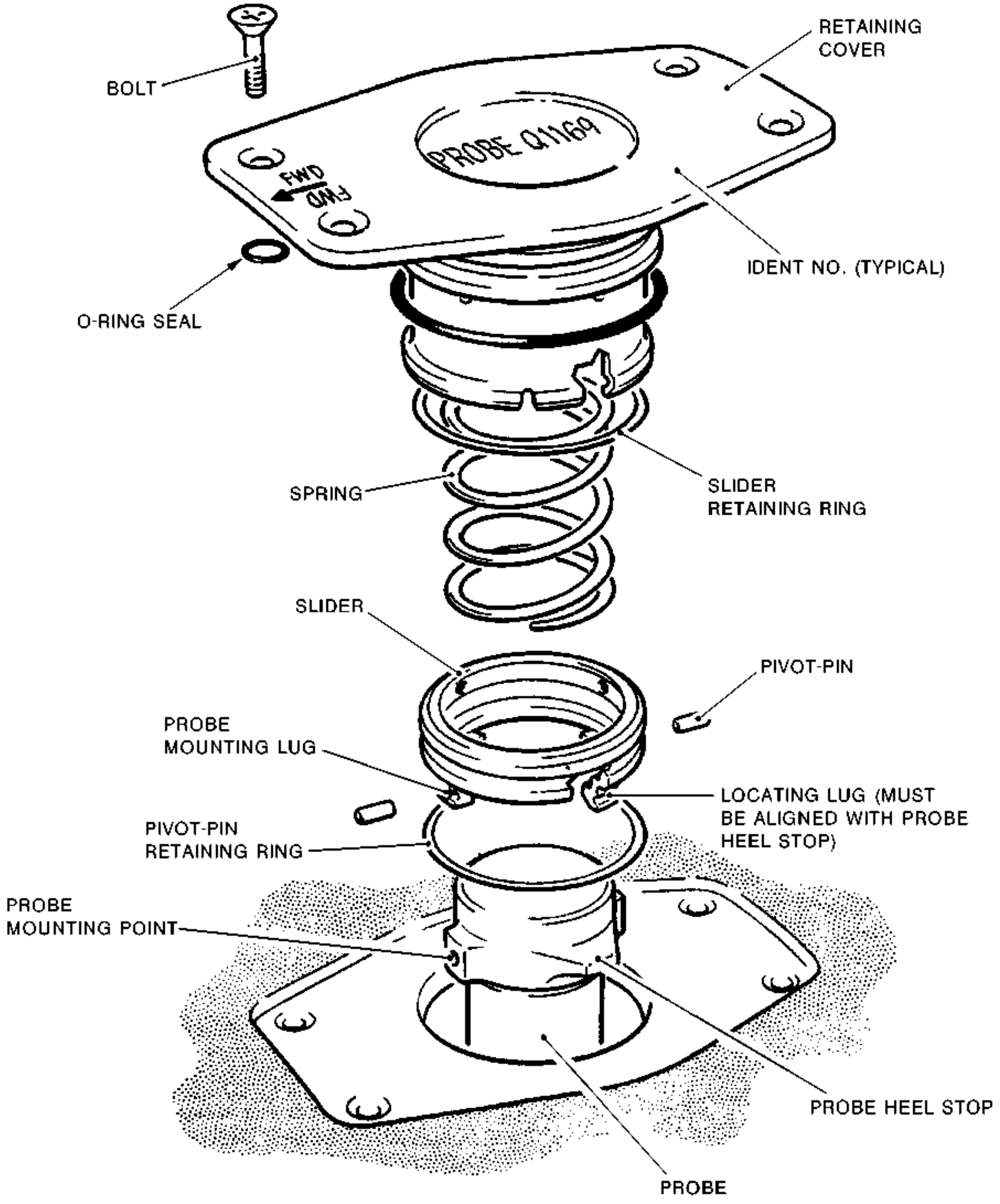

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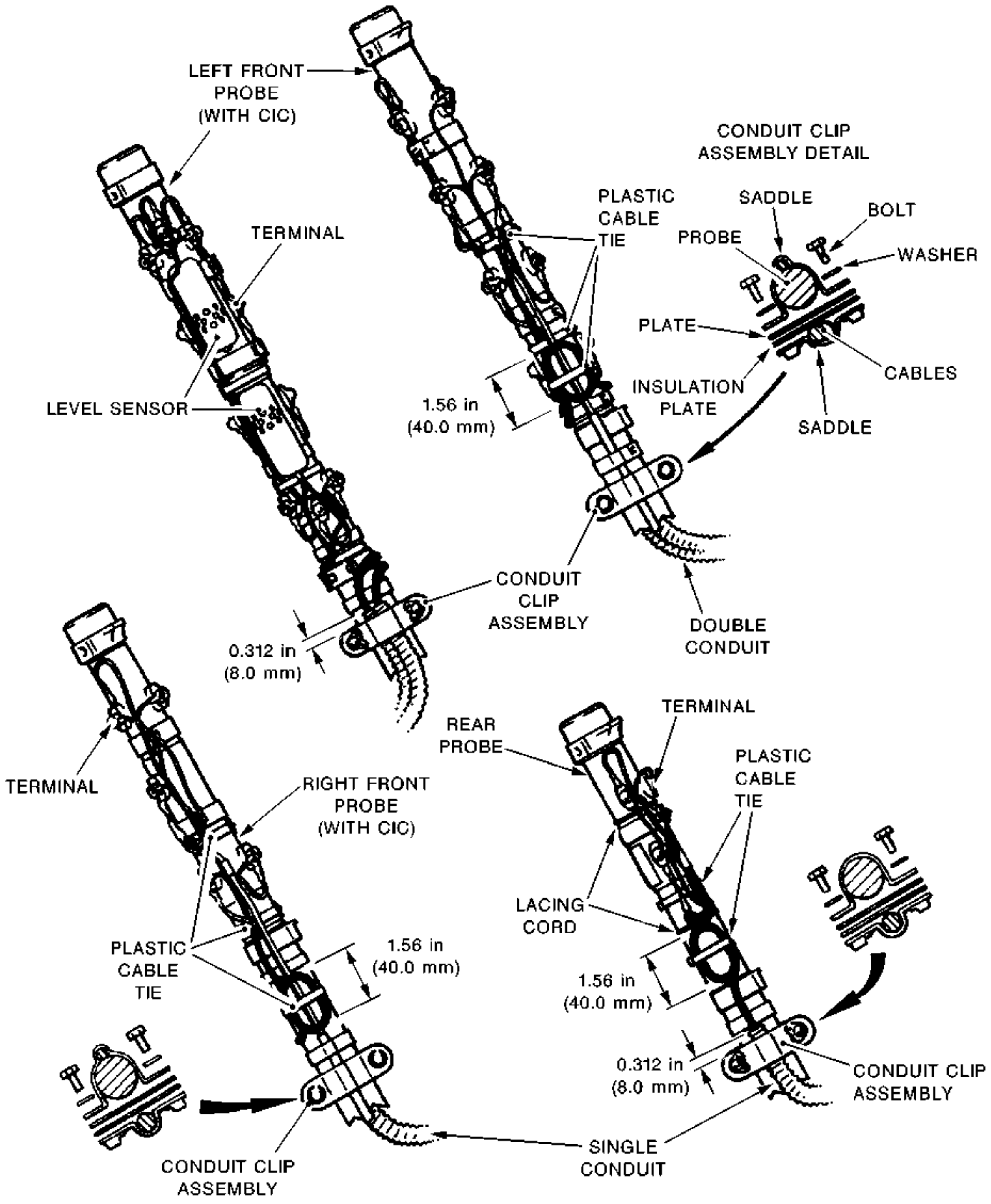
Typical Probe Retaining Cover
Figure 404



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Front and Rear Probes - Wiring Installation
Figure 405

(4) Refer to (Ref. Fig.401 and 402) as appropriate, then carefully withdraw the probe as far as the free conduit will permit, to effect the electrical wiring disconnection operations.

CAUTION: SECURE THE ELECTRICAL HARNESS TO A SUITABLE EXTERNAL SUPPORT, TO ENSURE THAT THE HARNESS CANNOT FALL INTO THE TANK, WHEN DISCONNECTED.

ENSURE THAT NO DEBRIS ENTERS THE TANK.

USE EXTREME CARE NOT TO DAMAGE THE ELECTRICAL CABLES OR INSULATION, WHEN SEVERING THE PLASTIC CABLE TIES OR LACING CORD.

(5) Using end- or side-cutters, with the blades held flat against the probe or cables, as necessary, sever the knots securing the lacing cord (if applicable), and the ends of the plastic cable ties. Remove and discard the lacing cord and cable ties.

(6) Disassemble and remove the conduit clip assembly.

(7) Uncoil the spare cable and withdraw the probe further from the tank if required.

(8) Disconnect the electrical cables from the probe by loosening the terminal screws and withdrawing the cable terminations.

(9) Withdraw the probe completely from the tank and fit a suitable blank to the access hole, with the harness adequately protected, and secured outside the tank.

CAUTION: DO NOT SCORE OR OTHERWISE DAMAGE THE PAINT FINISH OF THE RETAINING COVER.

(10) With the probe supported in a suitable clamp, disassemble the spring cap as follows:

(a) Compress the spring and remove the slider retaining ring.

(b) Gradually release the spring compression and withdraw the probe and slider assembly from the retaining cover. Remove the spring.

(c) Remove the pivot-pin retaining ring.

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(d) Support the slider and withdraw the pivot-pins.

NOTE: The pins are provided with an internal UNC 3B thread for extraction purposes.

(e) Remove and discard the O-ring seal.

D. Prepare to Install Front or Rear Probe (Ref. Fig.404)

(1) Inspect the retaining cover and ensure that it is free from contamination, damage or corrosion, and that the surface finish is intact.

(2) With the probe supported in a suitable clamp, assemble the spring cap assembly as follows:

(a) Install a new O-ring seal in its groove in the retaining cover. Lubricate the seal with clean, approved system fuel.

(b) Position the slider on the top of the probe with the probe heel stop coincident with and above the slider locating lug, then insert the pivot pin retaining ring.

(c) Insert the spring in the retaining cover.

(d) Position the slider assembly in the cover and compress the spring sufficiently to permit the slider retaining ring to be installed.

(e) With the slider retaining ring in position, gradually release the pressure on the spring.

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E. Install Front or Rear Probe (Ref. Fig.401, 402 and 405) (Ref. Fig.406)

NOTE: The arrow, which is engraved on each retaining cover, must point forward toward the aircraft nose. The front probes are positioned approximately vertically and slope slightly inboard from top to bottom. The rear probes face forward from top to bottom, but are angled approximately 10 deg inboard at the bottom.

With the exception of the dummy probe, a label, inscribed with an arrow and suitable instructions, is affixed to each probe. This arrow must be aligned with the arrow on the associated retaining cover, when the probe is in the installed configuration (Ref. Fig.406).

Due to the length of the probes they are supported, when installed, by a centre locating cone and a lower cone guide (front probe) or a cone lead-in locating foot (rear probe). A locating ring is fitted to each probe to support it in the centre locating cone.

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**ON A/C 001-006,

B NOTE: Due to an error some probes of Part No. 790-545-4 and
B 790-412-3 have been manufactured with their
B installation alignment arrows 180 deg out of position.

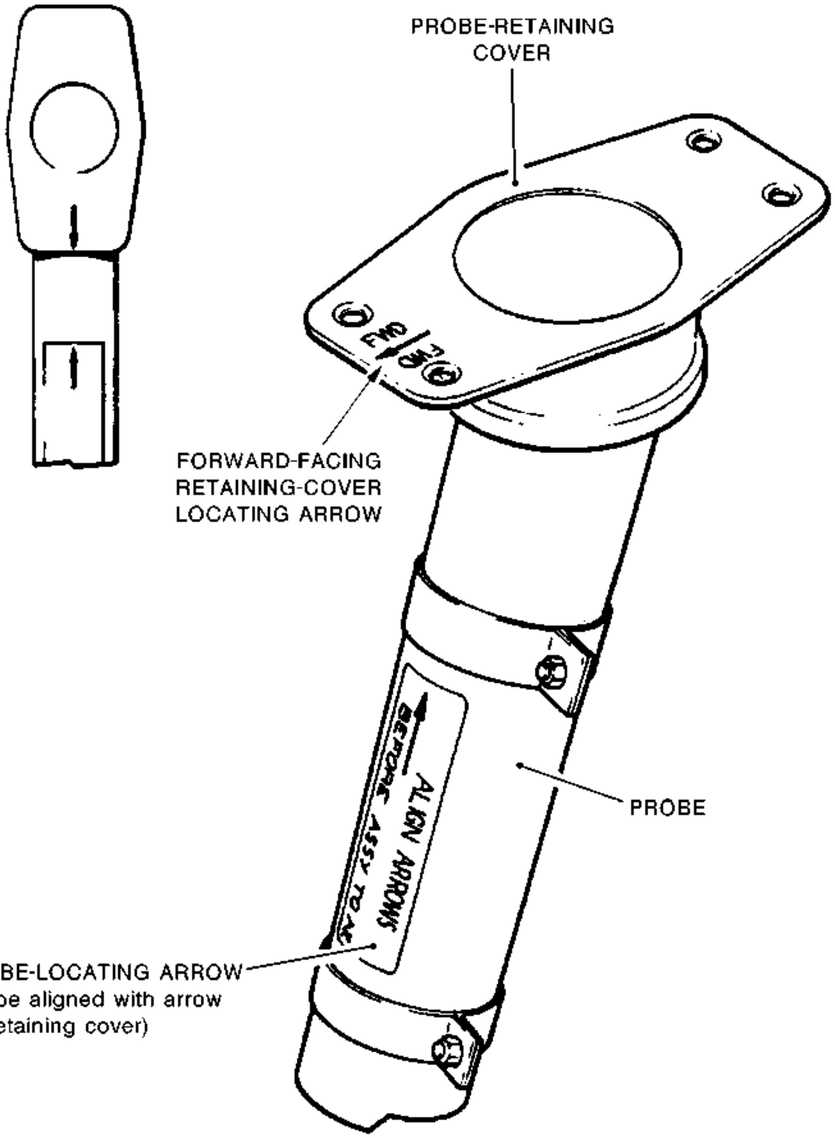
B Probes with this problem can be identified by the BAC
B code number 66-393-922 and 66-393-878 with the suffix -00.

B Rectification of these probes is by painting out the
B alignment arrows and changing the suffix to -01.

B Probes which have been manufactured with the correct
B arrows will be identifiable by the suffix -02.

(1) Comply with the fuel and electrical safety precautions.

(2) Pass the probe partly into the tank, and ensure that the base of the probe has passed through the centre locating cone.



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Probe to Retaining Cover Assembly Details
Figure 406

(3) Secure the cable conduit to the probe with the clip assembly. Ensure that the insulation plate is in position, and check that a nominal 0.312 in (8.0 mm) of conduit protrudes beyond the clip. Bind the probe, as necessary, with PTFE unsintered tape, as detailed in 20-27-15, to ensure that the conduit clip assembly is a snug fit on the probe without damaging it.

(4) With the cable routed along the probe, without twists or kinks, secure the terminations to the terminals in accordance with the Wiring Diagram Manual, 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(5) Make a coil of spare cable and position it as shown, with a lateral diameter of approximately the probe width, and a longitudinal diameter of approximately 1.56 in (40.0 mm). Secure the coil to the probe with a plastic able tie (Ref. Fig.405).

(6) Secure the remaining cables to the probe with plastic cable ties (front probe) or plastic cable ties and lacing cord (rear probe) as shown.

(7) Secure the cable ties in accordance with the Wiring Diagram Manual, 20-41-09. Secure the lacing cord with a clove hitch and a reef knot, and cut off any spare cord 0.25 in (6.35 mm) from the knot, taking care not to damage the cables or insulation.

(8) Pass the securing bolts through their holes in the retaining cover and install an O-ring seal on each bolt. Lubricate the seals with clean, approved system fuel.

(9) With the retaining-cover arrow facing forward (toward the nose of the aircraft), rotate the probe as necessary until the arrow on the probe is aligned with the arrow on the retaining cover (Ref. Fig.406).

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(10) Verify the probe position in relation to the retaining cover by ensuring that for a front probe the heel stop faces outboard at right angles to the axis of the aircraft, and for a rear probe the heel stop faces forward in line with the axis of the aircraft.

CAUTION: IF ANY UNDUE RESISTANCE IS FELT DURING THE FOLLOWING OPERATION, WITHDRAW THE PROBE AND INVESTIGATE THE CAUSE.

B IF UNSURE WHETHER PROBE HAS BEEN CORRECTLY
B POSITIONED IN LOCATING FOOT, THEN VISUALLY VERIFY
B BY EITHER REMOVING AN ADJACENT FUEL TANK ACCESS
B PANEL OR DEFUELLING AND ENTERING THE APPROPRIATE
B FUEL TANK (REF. MM 28-25-00). FAILURE TO LOCATE
B PROBES CORRECTLY CAN RESULT IN STRUCTURAL DAMAGE
B TO FUEL TANK WALLS.

(11) Pass the probe carefully into the tank, taking care not to damage any of the attachment fittings, until the probe is fully engaged in its locating cones.

(12) Press down the retaining cover by hand against the spring pressure, until it lies flush with the fuselage skin, then secure it with the bolts. Torque-tighten the bolts to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(13) Check that the electrical bonding is in accordance with 20-27-11.

F. Remove Dummy Probe (Ref. Fig.403)

(1) Perform operation B.(1).

(2) Using end- or side-cutters, with the blades held flat against the probe, sever the end of the cable tie and remove the tie. Ensure that all pieces of the tie are removed from the tank.

(3) Disconnect the electrical cables by loosening the terminal screws and withdrawing the cable terminations.

(4) Remove the conduit C-clip securing bolt and washer. Withdraw the spacer and remove the split bush.

(5) Attach the electrical harness temporarily to a suitable point within the tank.

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(6) Support the probe and unscrew the securing bolts, then remove the probe, complete with securing bolts, from the tank.

(7) Temporarily replace the tank access panel.

G. Prepare to Install Dummy Probe

(1) Check that the mounting bracket is free from cracks or corrosion, the mounting face is undamaged, and the anchor nuts are secure.

(2) Inspect the electrical cables and terminations, and repair them as necessary in accordance with the Wiring Diagram Manual, 20-42-29.

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H. Install Dummy Probe (Ref. Fig.403)

(1) Comply with the fuel and electrical safety precautions.

(2) Position the probe on the mounting bracket, with the dowel engaged in its locating hole.

(3) Secure the probe with the bolts. Torque-tighten the bolts to between 70 and 80 lbf in (0.791 and 0.904 mdaN).

(4) Route the electrical cable along the probe, without twists or kinks, and secure the terminations to the terminals in accordance with the Wiring Diagram Manual 20-42-49. Ensure that the connections are made in accordance with the cable identification and the applicable wiring diagram. Torque-tighten the terminal screws to between 8 and 9 lbf in (0.090 and 0.102 mdaN).

(5) Position the split bush around the conduit and install the C-clip and spacer, with a nominal 0.351 in (9.0 mm) of conduit protruding beyond the clip (to ensure that the conduit is secure).

(6) Secure the conduit clip assembly to the probe clamp with the bolt and washer. Support the clamp to ensure that the probe is not damaged, and torque-tighten the securing bolt to between 40 and 45 lbf in (0.452 and 0.508 mdaN).

(7) Secure the cable to the probe with a plastic cable tie as shown. Secure the cable tie in accordance with the Wiring Diagram Manual, 20-41-09.

(8) Check that the electrical bonding is in accordance with 20-27-11.

(9) Check that the tank is free from any foreign objects (tools or debris etc.).

R (10) Prior to tank close-up, visually inspect all bonding leads to ensure their integrity.

R NOTE: Any bonding lead which is found to be broken, frayed, or with braid loose in the crimp is to be replaced before the next flight.

R Bonding leads which show signs of surface corrosion only (characterized by sooty deposits or tarnishing) may be left installed.

R (11) Refit the access panel 311 CB as detailed in 28-10-00.

J. Conclusion

(1) Reset the circuit breakers tripped before probe removal.

(2) Refuel the tank as detailed in 28-24-00, and test for leaks as detailed in 28-12-51, Adjustment/Test.

(3) Perform an Operational Test of the FQI system as detailed in 28-44-00, Adjustment/Test, and the appropriate part of 28-40-00, Adjustment/Test.

(4) If the front left probe, or the dummy probe has been replaced, perform the appropriate section of the Functional Test detailed in 28-42-00, Adjustment/Test.

(5) Remove all tools and equipment from the area. Remove the warning placard from the flight compartment.

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CG PACKS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The three c.g. packs, main, standby 1 and standby 2, are housed in 1/4 ATR short cases, located on shelves 2-216, 10-216 and 9-216 in the flight compartment RH equipment racking, at the third crew member's (3CM) station.

2. CG Packs

A. Equipment and Materials

R

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

R R R

B. Prepare

(1) Electrically isolate the pack to be removed by tripping the appropriate circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
R ST'BY 1 BOUNDARY WARN SUP	1-213	Q1367	L18
ST'BY 1 CG LIMITS AND CG COMPN SUP	2-213	Q1361	A24
ST'BY 1 MACH LIMITS COMPN SUP	2-213	Q1362	B23
TOTAL FUEL AND MAIN CG COMPN SUP	2-213	Q1363	B24
ST'BY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
ST'BY 2 CG LIMITS AND CG COMPN SUP	4-213	Q1357	B2

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 9, 10, 11 REFUEL FQ1 AND FLT COUNT SUP	13-215	Q1365	C17
ST'BY 2 MACH LIMITS COMPN SUP	13-216	Q1364	D3

(2) Remove the appropriate cover from the RH equipment racking, and identify the unit to be removed.

C. Remove

(1) Disconnect the electrical connector(s) from the forward end of the pack.

(2) Loosen the clamping nut and swing the securing screw assembly clear of the hold-down hook.

(3) Grasp the carrying handle and withdraw the c.g. pack from the backplate connector; remove the unit from the shelf.

D. Install

(1) Comply with the electrical safety precautions.

(2) Ensure that the mating surfaces of the electrical connectors are clean and undamaged.

(3) Position the c.g. pack on the shelf runners, then slide the unit rearward until the backplate connector is engaged fully.

(4) Engage the securing screw assembly with the c.g. pack hold-down hook, and secure it with the clamping nut; ensure that the unit is bonded in accordance with 20-27-11.

R CAUTION: BEFORE SB 28-026, AFTER THE FOLLOWING OPERATION (5) THE COINCIDENCE OF THE ELECTRICAL PLUG AND RECEPTACLE IDENTIFICATION MUST BE CONFIRMED BY DUPLICATE INSPECTION, SINCE CROSS-CONNECTION IS POSSIBLE.

R (5) Connect the electrical connector(s) to the forward end of the pack, ensuring that the connections are made in accordance with the connector identification and the applicable wiring diagram.

R (6) Refit and secure the racking cover.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before pack removal.

(2) Perform an Operational Test of the system (Ref. 28-44-00, Adjustment/Test).

FQI CONTROL PANEL - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00, SERVICING.

1. General

RB CAUTION: THERE IS A CROSS CONNECTION POSSIBILITY WHEN WORKING WITH
RB THIS COMPONENT. CLEARLY IDENTIFY CONNECTIONS ON
RB DISCONNECTION AND FUNCTION CHECK UPON RECONNECTION.

A. The FQI control panel is a self-contained sub-panel mounted in the lower fuel management panel 5-214, at the third crew members (3CM) station.

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2. FQI Control Panel

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate the FQI control panel by tripping the associated circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FQI CONT PNL WARN & FUEL FLOW TEST SUP	1-213	Q1407	J17
TOTAL FUEL & MAIN CG COMPN SUP	2-213	Q1363	B24
STBY 2 CG LIMITS & CG COMPN SUP	4-213	Q1357	B 2
TANKS 9, 10, 11, REFUEL FQI & FLT COUNT SUP	13-215	Q1365	C17
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25

C. Remove

(1) Unscrew the FQI panel securing screws and withdraw the unit from its mounting aperture.

(2) Release the connector block securing screws and withdraw each connector, in turn, from the FQI control panel.

D. Install

NOTE: The standby 1 and 2 c.g. pack connectors (left and centre) are similar, and must be connected in accordance with the appropriate wiring diagram.

(1) Connect each connector in turn, and secure it with the screws and locking clips.

(2) Insert the FQI control sub-panel into its aperture in the lower fuel management panel, and secure it with the securing screws.

E. Conclusion

(1) Reset the circuit breakers tripped before panel removal.

(2) Perform an Operational Test of the FQI control panel circuit as detailed in 28-44-00, Adjustment/Test.

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FUEL CONTENTS INDICATORS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00, SERVICING.

1. General

RB CAUTION: THERE IS A CROSS CONNECTION POSSIBILITY WHEN WORKING WITH
RB THIS COMPONENT. CLEARLY IDENTIFY CONNECTIONS ON
RB DISCONNECTION AND FUNCTION CHECK UPON RECONNECTION.

A. The fuel contents indicators are installed in two locations: at the third crew member's (3CM) station, on the adjacent fuel management panels 2-214 and 5-214, and on the ground refuel panel 1-194.

B. The instruments are duplicated, except for tanks 9, 10 and 11, and having similar physical characteristics can be installed in either location. The indicators for tanks 9, 10 and 11 however, are not interchangeable, as the internal mechanisms of those installed in the fuel management panel require longer cases, which are fitted with locating spigots. These indicators are supplied with two electrical connectors for channels A and B, and cannot be installed in the refuel panel.

C. The refuel panel indicators for tanks 9, 10 and 11 have shorter cases than those fitted in the fuel management panel, and one electrical connector, and cannot be installed in that location.

2. Fuel Contents Indicators

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Torque spanner, 5 to 8 lbf in (0.0565 and 0.0904 mdaN)	-

B. Prepare

(1) For removal of a fuel management panel indicator, isolate the electrical generation and external power equipment as detailed in 24-00-00, Servicing.

(2) For removal of a refuel panel indicator, trip the associated circuit breakers. Fit safety clips.

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SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
TANKS 3 & 4 FQI SUP	4-213	Q1354	C 1
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C 2
TANKS 9, 10 & 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B 1
TANKS 9, 10 AND 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 9, 10 & 11 REFUEL FQI & FLT COUNT SUP	12-215	Q1365	C17
GRND POWER REFUEL CONT & IND	25-216	Q 635	B 8

C. Remove

(1) Fuel Management Panel Indicator

(a) Gain access to the rear of the appropriate panel by releasing the quick-release fasteners, then press in the spring retaining clip at each side of the panel and lower it on its hinges.

(b) Disconnect the electrical connector(s) from the indicator to be removed.

(c) Close the panel and secure it temporarily with the quick release fasteners.

(d) Loosen the clamp securing screws at the front of the instrument panel, sufficiently to permit the indicator to be withdrawn.

(e) Carefully withdraw the indicator from the panel.

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(2) Refuel Panel Indicator

(a) Loosen the clamp securing screws sufficiently to permit the indicator to be withdrawn.

(b) Carefully withdraw the indicator from the instrument panel and disconnect the electrical connector.

D. Install

(1) Fuel Management Panel Indicator

(a) Comply with the electrical safety precautions.

(b) Slide the indicator carefully into its panel aperture until the face is aligned correctly.

NOTE: For tank 9, 10 or 11 indicator installation, it may be necessary to lower the instrument panel at this stage, to ensure that the locating spigot on the instrument case has engaged correctly in the supporting lug on the cable carrier.

(c) With the indicator positioned correctly, torque-tighten the clamp securing screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

(d) Lower the instrument panel and connect the electrical connector(s) to the indicator, ensuring that the mating surfaces are clean and undamaged.

(e) Close the panel and secure it with the quick-release fasteners.

(2) Refuel Panel Indicator

(1) Comply with the electrical safety precautions.

(b) Connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(c) Slide the indicator carefully into its panel aperture until the face is aligned correctly.

(d) With the indicator positioned correctly torque-tighten the clamp securing screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

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E. Conclusion

(1) Cancel the electrical isolation procedures applied before indicator removal, or remove the safety clips and reset the appropriate circuit breakers, as applicable.

(2) Perform an Operational Test of the indicator as detailed in 28-44-00, Adjustment/Test.

B CAUTION: DUE TO THE POSSIBILITY OF CROSS CONNECTING, IF ANY
B OF THE PAIRS OF INDICATORS 1/2, 3/4 AND 9/10 HAVE
B BEEN DISTURBED DURING THE SAME MAINTENANCE INPUT
B THEN COMPLETE THE FOLLOWING SUB-PARA. (3).

B (3) By internal fuel transfer (Ref. 28-22-00) transfer a
B sufficient amount of fuel (approx. 880 lbs (400 Kgs)) into
B the appropriate tank. Ensure that the corresponding
B indicator registers the increase in fuel contents.

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FUEL TOTALISER (TOTAL CONTENTS) INDICATORS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The fuel totaliser (total contents) indicators are installed in three locations:-

(1) On the pilot's centre instrument panel 6-211.

(2) On the lower fuel management panel 5-214, at the 3CM station.

(3) On the ground refuel panel 1-194.

Refer to 28-24-00 for the ground refuel panel access instructions.

2. Fuel Totaliser Indicators

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	D925203001

B. Prepare

(1) Electrically isolate the indicator to be removed by tripping the appropriate indicator(s) power and lighting supplies circuit breakers; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Fuel management and pilots' centre instrument panel indicator power supplies			
TOTAL FUEL AND MAIN CG COMPN SUP	2-213	Q1363	B24

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 9, 10, 11 REFUEL FQI AND FLT COUNT SUP	13-215	Q1365	C17
Fuel management panel indicator lighting supplies			
R 3CM STN INST LTSSUP	13-216	L377	E7
3CM STN CTR LT TEST SUP	15-215	L1005	D13
Pilots' centre instrument panel indicator lighting supplies			
CTR DASH & G/SHIELD INST LTS SUP	14-216	L375	D10
PLTS LT TEST SUP	15-215	L1001	E14
Refuel panel indicator power supply			
GRND POWER REFUEL CONT & IND	25-216	Q635	B8

C. Remove

(1) Remove the indicator securing screws and withdraw the instrument from the panel.

(2) Disconnect the electrical connector and remove the indicator.

D. Install

(1) Comply with the electrical safety precautions.

(2) Connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(3) Install the indicator in the panel aperture and secure it with the screws.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before indicator removal.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Check that the failure warning flag is withdrawn, and that the indicator is illuminated evenly.

(4) Test the indicator by carrying out the Operational Test detailed in 28-44-00, Adjustment/Test.

CG INDICATORS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The c.g. indicators are installed in two locations:-

(1) On the lower fuel management panel 5-214, next to the FQI control panel, at the 3CM station.

(2) On the pilots' left instrument panel 2-211.

2. CG Indicators

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	D925203001

B. Prepare

(1) Electrically isolate the c.g. indicator to be removed by tripping the associated circuit breakers; fit safety clips.

R **ON A/C 006-007,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Pilot's c.g. indicator			
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
STBY 1 BOUNDARY WARN SUP	1-213	Q1367	K18
RH DASH INST LTS SUP	13-216	L371	E9

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
PLTS LT TEST SUP	15-215	L1001	E14
3CM c.g. indicator			
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1
STBY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
3CM STN INST LTS SUP	13-216	L377	E7
3CM STN CTR LT TEST SUP	15-215	L1005	D13

**ON A/C 001-005,

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
Pilot's c.g. indicator			
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
TANKS 9, 10, 11 FQI CHA & PLTS CG IND SUP	2-213	Q1358	A18
STBY 1 BOUNDARY WARN SUP	1-213	Q1367	L18
RH DASH INST LTS SUP	13-216	L371	E9
PLTS LT TEST SUP	15-215	L1001	E14
3CM c.g. indicator			
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
TANKS 9, 10, 11 FQI CHB & 3CM CG IND SUP	4-213	Q1356	B1

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
STBY 2 BOUNDARY WARN SUP	3-213	Q1366	F7
3CM STN INST LTS SUP	13-216	L377	E7
3CM STN CTR LT TEST SUP	13-215	L1005	D13

C. Removal

(1) Remove the indicator securing screws and withdraw the instrument from the panel.

(2) Disconnect the electrical connector and remove the indicator.

D. Install

(1) Comply with the electrical safety precautions.

(2) Connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(3) Install the indicator in the panel aperture and secure it with the screws.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before indicator removal.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Check that the failure warning flag is withdrawn, and that the indicator is illuminated evenly.

(4) Test the operation of the bezel-mounted red warning lamp (Ref. 33-14-00).

(5) Test the indicator by performing the Operational Test detailed in 28-44-00, Adjustment/Test.

QUANTITY PACKS - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The two fuel quantity packs are housed in 1/4 ATR short cases. The channel A (LH) pack is mounted on shelf 10-216; the channel B (RH) pack is mounted on shelf 9-216, in the flight compartment RH equipment racking, at the third crew member's (3CM) station. The instructions detailed for the removal/installation of one pack are applicable to both.

2. Quantity Packs

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate the pack to be removed by tripping the appropriate channel circuit breakers, including the FQI CONT PNL WARN & FQI TEST SUP circuit breaker; fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
FQI CONT PNL WARN & FQI TEST SUP	15-215	Q1021	G25
Channel A (LH) quantity pack			
TANKS 9, 10, 11 FQI CH B & 3CM CG IND SUP	4-213	Q1356	B1
TANKS 9, 10, 11 FQI CH A & PLTS CG IND SUP	2-213	Q1358	A18
TANKS 5, 5A & 6 FQI SUP	2-213	Q1359	A22

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANKS 1 & 2 FQI SUP	2-213	Q1360	A23
Channel B (RH) quantity pack			
TANKS 3 & 4 FQI SUP	4-213	Q1354	C1
TANKS 7, 7A & 8 FQI SUP	4-213	Q1355	C2
TANKS 9, 10, 11 FQI CH B & 3CM CG IND SUP	4-213	Q1356	B1
TANKS 9, 10, 11 FQI CH A & PLTS CG IND SUP	2-213	Q1358	A18

(2) Remove the appropriate cover from the RH equipment racking, and identify the unit to be removed.

C. Remove

R (1) Disconnect the electrical connectors from the forward
R end of the pack.

R (2) Loosen the clamping nut and swing the securing screw assembly clear of the hold-down hook.

R (3) Grasp the carrying handle and withdraw the quantity pack from the backplate connector; remove the unit from the shelf.

R (4) Position a suitable blank to cover the exposed metering plate on the rack (Ref. 21-21-00, Servicing).

D. Install

(1) Comply with the electrical safety precautions.

(2) Remove the blank from the airflow metering plate on the rack.

(3) Ensure that the mating surfaces of the electrical connectors are clean and undamaged.

(4) Position the quantity pack on the shelf runners, then slide the unit rearward until the backplate connector is engaged fully.

(5) Engage the securing screw assembly with the pack hold-down hook, and secure it with the clamping nut; ensure that the unit is bonded in accordance with 20-27-11.

R CAUTION: BEFORE SB 28-026, AFTER THE FOLLOWING OPERATION (5) THE COINCIDENCE OF THE ELECTRICAL PLUG AND SOCKET IDENTIFICATION MUST BE CONFIRMED BY DUPLICATE INSPECTION, SINCE CROSS-CONNECTION IS POSSIBLE.

(6) Connect the electrical connectors to the forward end of the pack, ensuring that the connections are made in accordance with the connector identification and the applicable wiring diagram.

(7) Refit and secure the racking cover.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before pack removal.

(2) Perform an Operational Test of the system (Ref. 28-44-00, Adjustment/Test).

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FUEL TEMPERATURE INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig.001 and 002)

The fuel temperature indication system monitors the fuel temperature at each collector tank outlet, and at the associated engine inlet. Temperature sensors are housed in pockets upstream of the fuel to hydraulic heat exchanger, and downstream of the fuel to air heat exchanger, before the supply pipe joins the engine fuel system. The sensors are connected electrically to a twin dial indicator and an associated double-pole, four-position rotary switch, on the upper fuel management panel 2-214.

2. Sensor

The temperature sensors are immersion-type platinum resistance thermometers with an ice point resistance of 130 ohm, and comprise a sensor, a pocket and a retaining nut.

The pocket is permanently installed to permit removal/installation of the sensor, without the necessity for fuel draining, and is rendered fuel-tight by an O-ring seal. The sensor is retained in the pocket by the nut; electrical connection is effected by a bayonet-type connector.

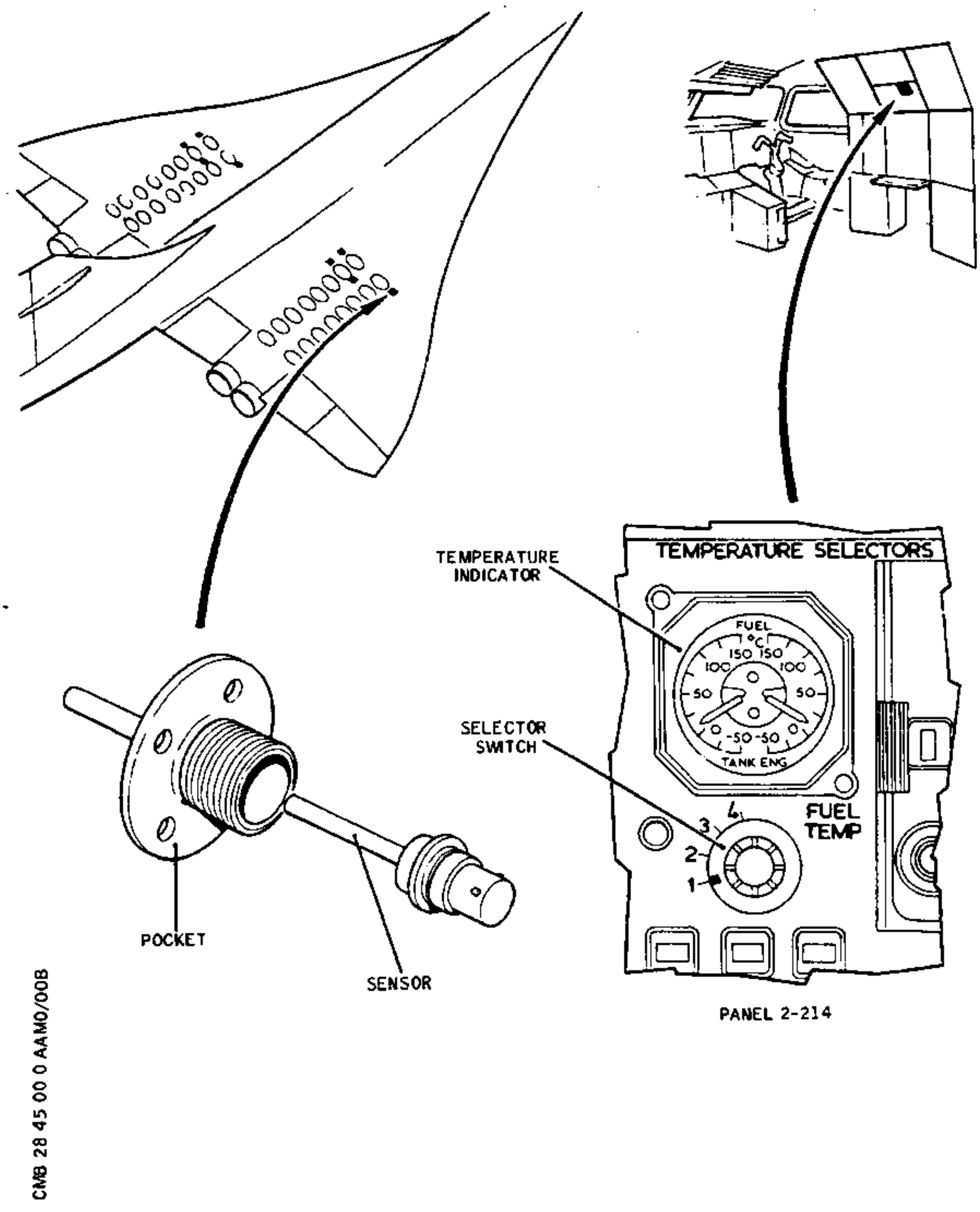
The sensors are connected to the FUEL TEMP selector switch in pairs, for example, No.1 fuel collector tank outlet, No.1 engine inlet and so on, to enable the temperature of each system to be monitored by both sensors simultaneously, according to the selected switch position, 1, 2, 3 or 4.

3. Indicator

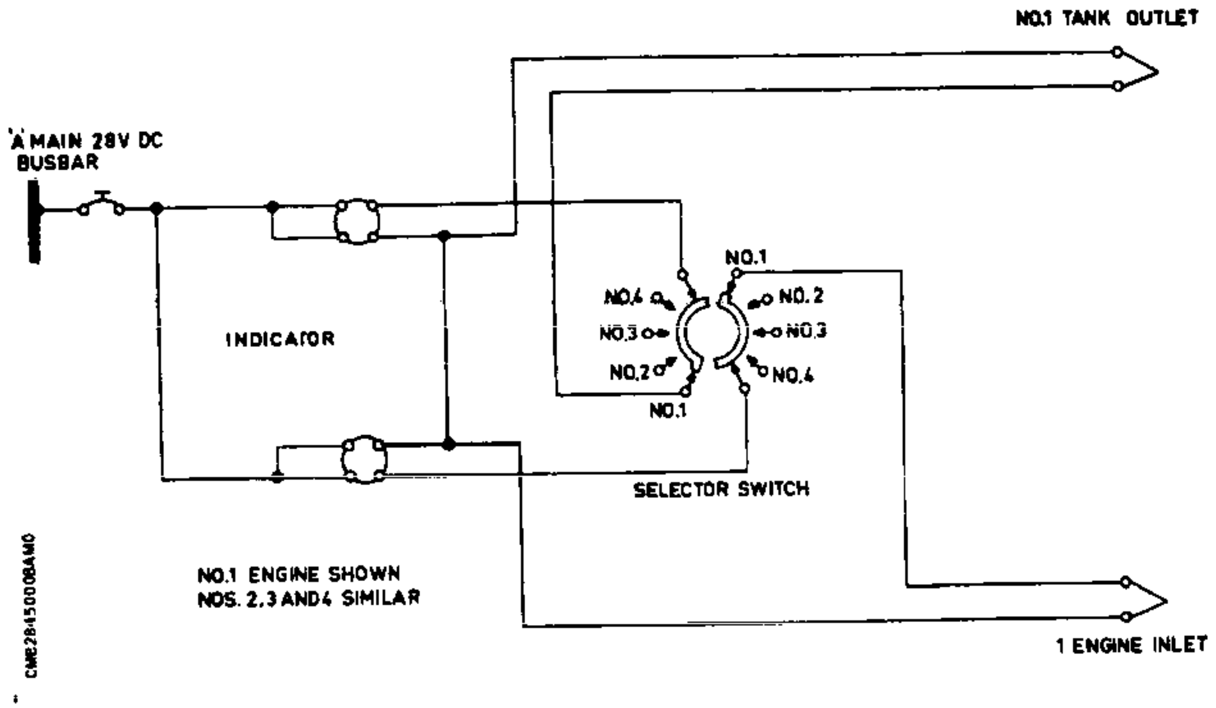
The twin dial indicator, in conjunction with the sensors, registers fuel temperature on two semi-circular dials. The left dial is engraved TANK, the right dial is engraved ENG, and each is calibrated from -50 to 150 deg C.

The indicator comprises two similar, but handed, moving coil assemblies, each with two opposed windings, positioned around a permanent magnet. The movement, together with the necessary calibrating and trimming resistors, is secured to a frame. Pointer spiders are secured to the moving coil assemblies and carry the dial pointers. The unit is housed in a 2 ATI case and the presentation is integrally illuminated.

4. Operation



Fuel Temperature Indication System
Figure 001



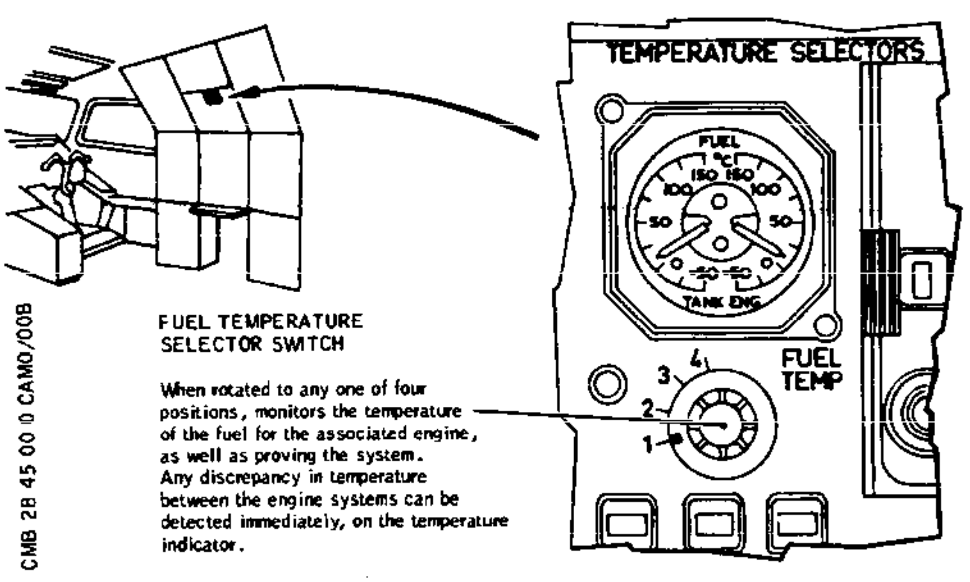
- Fuel Temperature Indication - Electrical Schematic
Figure 002

A. Functional Description

With electrical power supplies connected to the system, simultaneous but independent readings are presented on the indicator dials, directly proportional to the temperature at the sensors. Any variation in the fuel temperature results in a change in the resistance of the sensing element in a sensor. The resultant variation in the signal transmitted to the indicator varies the deflection of the dial pointer, to present the fuel temperature in deg C.

Rotation of the selector switch to any one of the four positions, 1, 2, 3 or 4, completes the circuit from the selected pair of sensors, to give indication of the temperature of the fuel in the associated engine system.

5. System Management (Ref. Fig. 003)



System Management
Figure 003

The four-position switch on the fuel management panel provides a facility for monitoring the temperature of the fuel for each individual engine, as well as proving the system. Any discrepancy in temperature between the systems can be detected immediately, either as a pre-flight check, or for servicing purposes.

To enable these checks to be performed, electrical power must be available, and the engine fuel systems must be charged with fuel.

6. Electrical Power Supplies

Electrical power supplies are taken from the 'A' main 28 V d.c. busbar.

FUEL TEMPERATURE INDICATION - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

Each of the four fuel temperature indication systems comprises two sensors and associated circuitry, operating through a common temperature indicator, and a four-position rotary selector switch. Where two or more identical components are involved, that is, one in each circuit, all references to the associated components listed in Table 101 are given, for example, 'Renew Temperature Sensor (2), (4), (6) or (8)'.

2. Preparation

A. Ensure that the circuit breaker is set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Gain access to the temperature sensors as required.

3. Trouble Shooting

A. Prepare to trouble shoot (Ref. para.2.). Check that the TANK and ENG indicator pointers read ambient temperature (with engines cool) at each position (1, 2, 3 or 4) of the temperature selector switch. IF -

NOT OK

1. Indicator dial pointers remain at zero, irrespective of temperature selector switch position - Chart 101.
2. Either or both of the indicator dial pointers read incorrectly at
   (a) one selector switch position, or
   (b) all switch positions - Chart 102.

B. Check system out as detailed in Adjustment/Test. IF -

OK

Indicator readings not within permitted tolerances - renew Indicator (10).

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INDICATOR DIAL POINTERS REMAIN AT ZERO, IRRESPECTIVE OF SELECTOR SWITCH POSITION.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

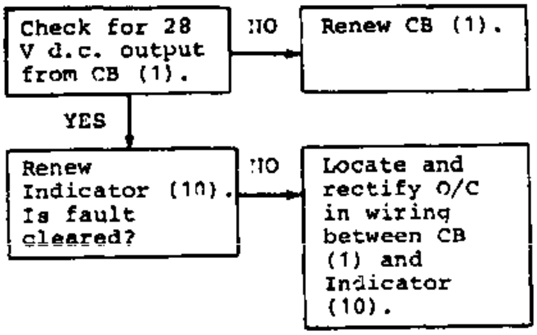

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Chart 101

EITHER OR BOTH OF THE DIAL POINTERS READ INCORRECTLY AT -
(a) ONE SELECTOR SWITCH POSITION, OR
(b) ALL SWITCH POSITIONS.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

NOTE: Before renewal of components (*), check the preceding run of wiring for continuity.

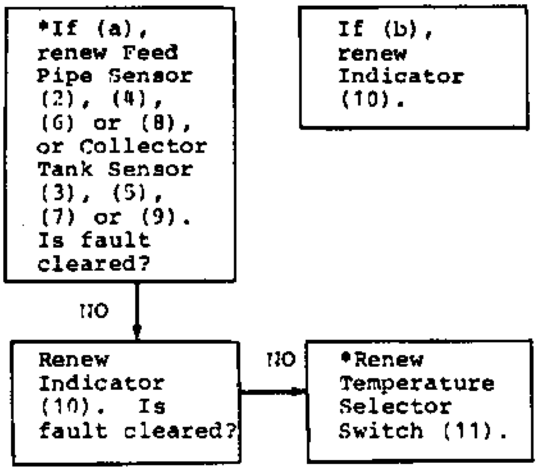

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Chart 102

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(1) Circuit breaker 28 V	-	15-215	D1	Map ref.B25	24-50-00 R/I	28-45-01
(2) No.1 engine inlet sensor	532-CT	-	1D5	No.1 dry bay	28-45-12 R/I	28-45-01
(3) No.1 collector tank sensor	532-AT	-	1D4	No.1 dry bay	28-45-12 R/I	28-45-01
(4) No.2 engine inlet sensor	531-BT	-	2D5	No.2 dry bay	28-45-12 R/I	28-45-01
(5) No.2 collector tank sensor	531-AT	-	2D4	No.2 dry bay	28-45-12 R/I	28-45-01
(6) No.3 engine inlet sensor	631-BT	-	3D5	No.3 dry bay	28-45-12 R/I	28-45-01
(7) No.3 collector tank sensor	631-AT	-	3D4	No.3 dry bay	28-45-12 R/I	28-45-01
(8) No.4 engine inlet sensor	632-CT	-	4D5	No.4 dry bay	28-45-12 R/I	28-45-01
(9) No.4 collector tank sensor	632-AT	-	4D4	No.4 dry bay	28-45-12 R/I	28-45-01
(10) Temper-ature indicator	-	2-214	D2	3CM station	28-45-11 R/I	28-45-01

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	MANUAL REF. WIRING DIAGRAM
(11) Temperature selector switch	-	2-214	D3	3CM station	-	28-45-01

Component Identification
Table 101

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FUEL TEMPERATURE INDICATION - ADJUSTMENT/TEST

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General

This topic comprises an Operational Test and a Functional Test. A System Test is not considered necessary in this application.

2. Operational Test

A. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

B. Test

(1) Refer to the TEMPERATURE SELECTORS section of the upper fuel management panel 2-214.

(2) With the FUEL TEMP selector rotary knob set to '1', check that the indicator dial pointers indicate ambient temperature.

(3) Rotate the knob to "2", "3" and "4" in turn, and check that the readings at each position agree with each other and the No.1 position reading.

(4) Return the knob to position "1".

C. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

3. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Insulation resistance tester	-
Decade resistance boxes (2)	-

Low voltage resistance tester	-
Circuit breaker safety clip	-
R Access panel key	E920132000

B. Prepare

(1) Make available electrical ground power as detailed in 24-41-00.

(2) Refer to panel 15-215 and trip circuit breaker D1, map ref.B25.

(3) Gain access to the temperature sensors by removing the appropriate access panels (Ref. Table 501), from the top surface of the wing above the engine dry bay area.

TEMPERATURE SENSOR LOCATION	ZONE/ACCESS PANEL
No.1 engine feed pipe	532 CT
No.1 collector tank	532 AT
No.2 engine feed pipe	531 BT
No.2 collector tank	531 AT
No.3 engine feed pipe	631 BT
No.3 collector tank	631 AT
No.4 engine feed pipe	632 CT
No.4 collector tank	632 AT

Sensor Location
Table 501

(4) Disconnect the electrical connectors from the eight sensors.

C. Test

(1) Check that the temperature indicator on panel 2-214 is not indicating.

(2) At zone 532 (No.1 engine position) connect a decade resistance box to pins A and B of each free electrical connector; set the resistance to 104 ohm.

(3) Check that the temperature indicator is not indicating, then reset circuit breaker D1.

(4) Refer to Table 502; set the resistance boxes to give each of the listed temperatures (on both scales on the temperature indicator), then verify that the resistance values are within the limits detailed.

INDICATED TEMPERATURE (deg C)	RESISTANCE VALUE (ohm)
-50	101.5 - 106.5
0	127.5 - 132.5
+50	153.0 - 158.0
+100	178.2 - 183.2
+150	203.0 - 208.0

Indicator Calibration
Table 502

(5) Trip circuit breaker D1 and check that all indication is cancelled.

(6) Disconnect the resistance boxes from the electrical connectors.

(7) Repeat operations (2) to (6) as applied to Nos.2, 3 and 4 engine systems, in turn.

(8) Using a suitable low voltage resistance tester, check the continuity of each sensor element between pin A and pin B; the resistance must

be approximately 140 ohm at room temperature (20 deg C).

(9) Using a 250 V insulation resistance tester, check that the insulation resistance between the element pins and the sensor body is greater than 20 Mohm.

(10) Reconnect the electrical connectors to the sensors.

(11) Reset circuit breaker D1.

(12) Check that both scales on the temperature indicator read ambient temperature at selector positions 1, 2, 3 and 4.

D. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(2) Remove all test equipment from the aircraft.

(3) Replace the wing access panels.

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FUEL TEMPERATURE INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

The fuel temperature indicator is mounted on the upper fuel management panel 2-214. One indicator serves the four pairs of temperature sensors through the FUEL TEMP selector switch.

2. Fuel Temperature Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Electrically isolate the indicator by tripping the FUEL TEMP IND circuit breaker D1 on panel 15-215, map ref.B25, and the 3CM STN INST LTS SUP circuit breaker L377, on panel 13-216, map ref.E7; fit safety clips.

C. Remove

(1) Unscrew the instrument clamp adjusting screws sufficiently to permit the indicator to be withdrawn.

(2) Withdraw the indicator from the panel and disconnect the electrical connector.

D. Install

(1) Comply with the electrical safety precautions.

(2) Connect the electrical connector to the indicator, ensuring that the mating surfaces are clean and undamaged.

(3) Insert the indicator in the panel aperture.

(4) Align the face of the indicator correctly and

torque-tighten the clamping screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Check the indicator operation as detailed in 28-45-00, Adjustment/Test.

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TEMPERATURE SENSOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. GENERAL (Ref. Fig. 401)

The fuel temperature sensors are located in the wing dry bay area above the engine nacelles. The removal/installation instructions detailed are applicable to all eight sensors.

2. Temperature Sensor (Ref. Fig.402 and 403)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-
Engine feed pipeline drain equipment	D925377000
Access panel key	E920132000
Torque spanner, 9 to 11 lbf in (0.102 to 0.124 mdaN)	-

B. Prepare

(1) Electrically isolate the temperature sensors by tripping the FUEL TEMP IND circuit breaker D1 on panel 15-215, map ref.B25; fit a safety clip.

(2) Using the key, unlock and remove the appropriate wing access panel listed in Table 401.

TEMPERATURE SENSOR IDENT.	ZONE/ACCESS PANEL IDENT.
No.1 engine feed pipe	532-CT
No.1 collector tank	532-AT
No.2 engine feed pipe	531-BT

TEMPERATURE SENSOR IDENT.	ZONE/ACCESS PANEL IDENT.
No.2 collector tank	531-AT
No.3 engine feed pipe	631-BT
No.3 collector tank	631-AT
No.4 engine feed pipe	632-CT
No.4 collector tank	632-AT

Access Panel Location
Table 401

C. Remove

(1) Identify the sensor to be removed and disconnect the electrical connector.

(2) Remove the retaining nut and withdraw the sensor from the pocket.

D. Prepare to Install

(1) Check that the sensor is free from cracks, corrosion, or other damage.

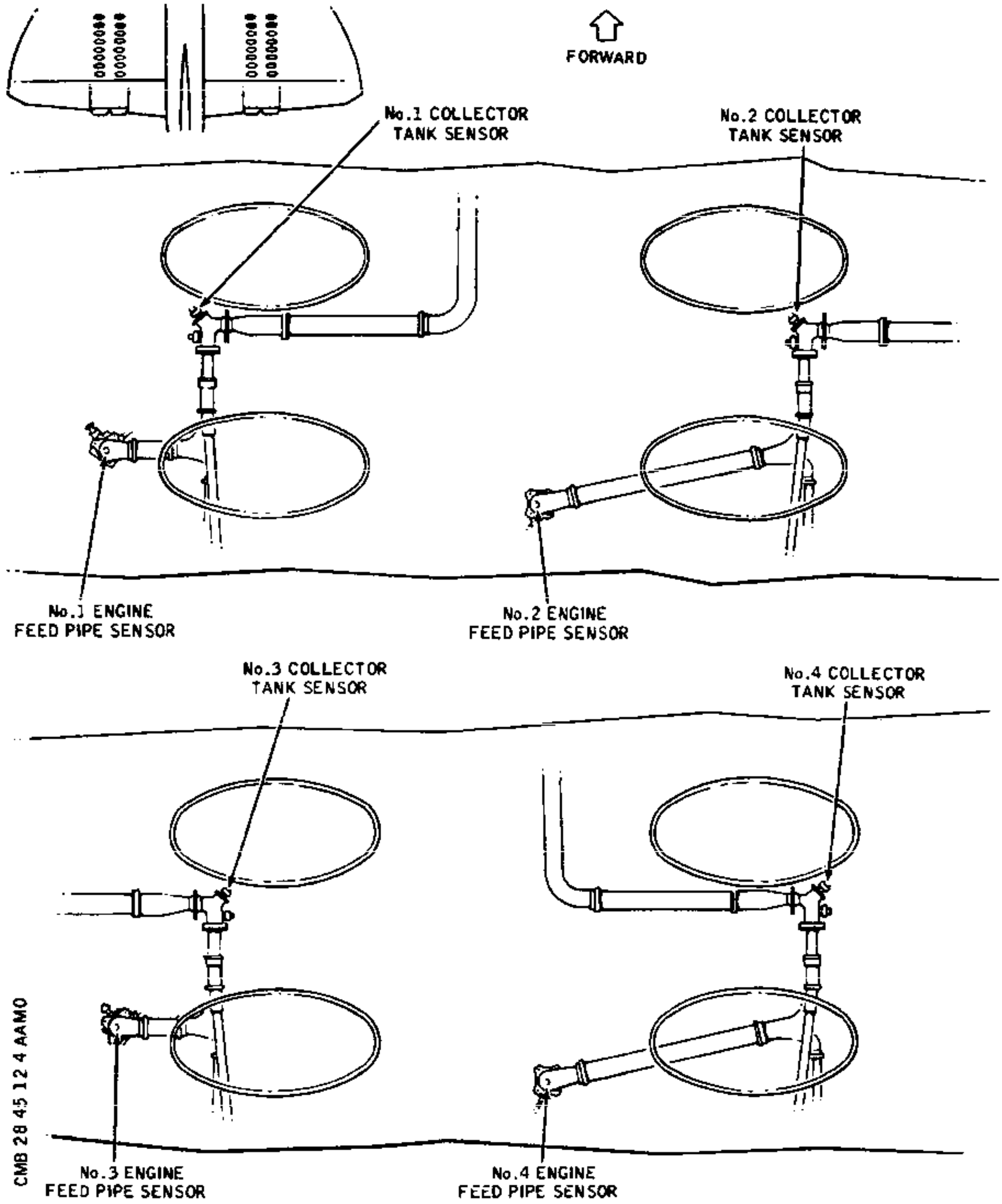
(2) Using a suitable low voltage resistance tester, check the continuity of the element between pin B and either pin A or pin C; the resistance should be 140 ohm at room temperature (20 deg C).

(3) Using a 250 V insulation resistance tester, check that the insulation resistance between the element pins and the sensor body is greater that 20 Mohm.

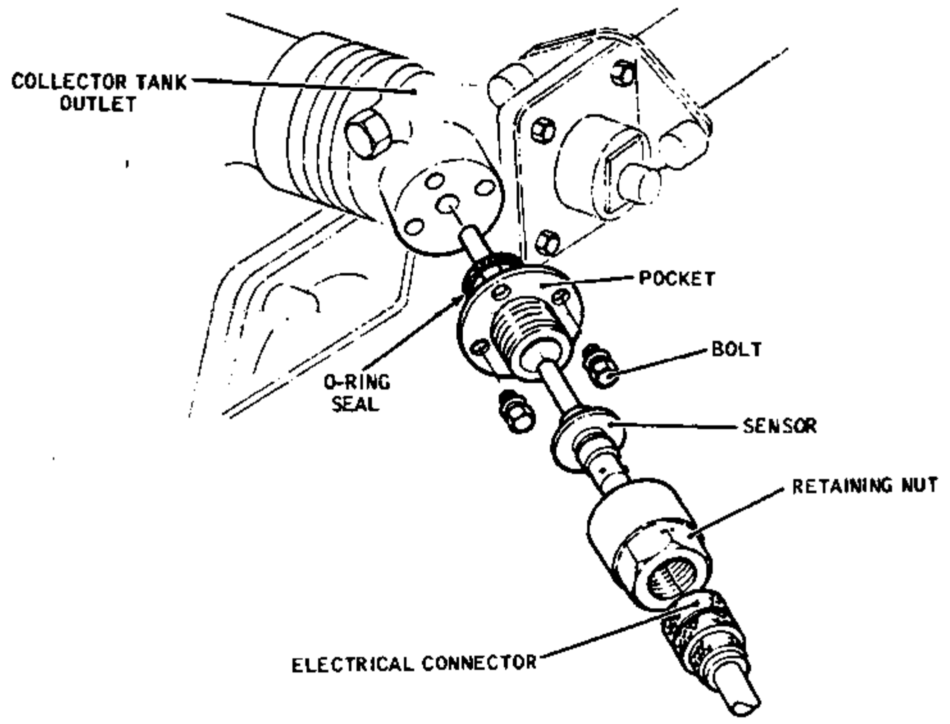
E. Install

(1) Comply with the electrical safety precautions.

(2) Position the sensor in the pocket; torque-tighten
R the retaining nut to between 9 and 11 lbf in
R (0.102 and 0.124 mdaN), and lock it with 0.032 in (0.813 mm) dia. wire (DTD 189) as detailed in 20-23-11 and 20-21-13.



Location of Temperature Sensors
Figure 401



- Collector Tank Temperature Sensor - Installation
Figure 402

(3) Connect the electrical connector to the sensor, ensuring that the mating surfaces are clean and undamaged.

F. Conclusion

(1) Using the key, refit and lock the wing access panel.

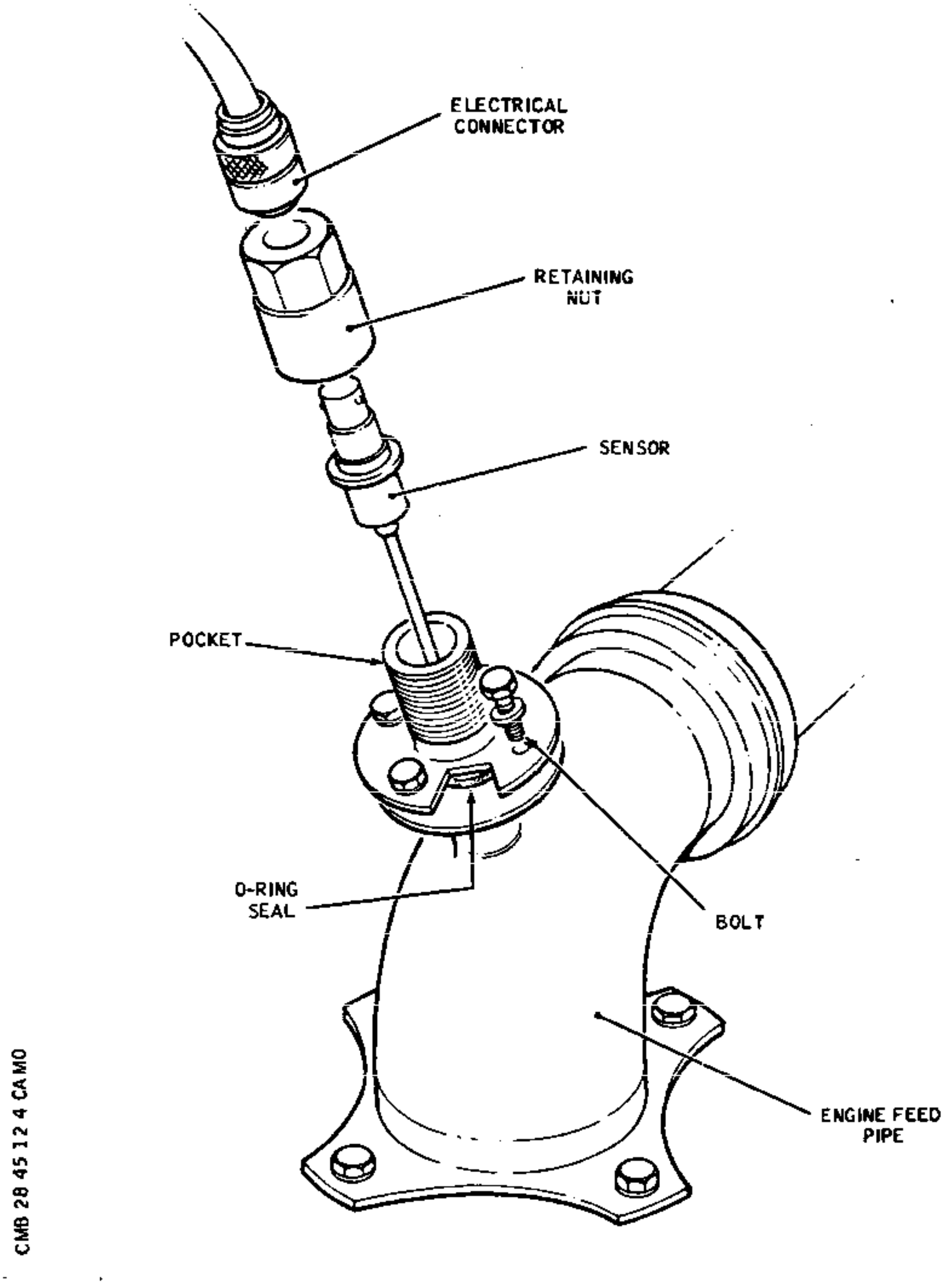
(2) Reset the circuit breaker, tripped before sensor removal.

(3) Check the operation of the fuel temperature indication system as detailed in 28-45-00, Adjustment/Test.

3. <u>Sensor Pocket</u>

A. Prepare to Remove

<u>CAUTION</u>: ISOLATE AND DRAIN THE ASSOCIATED ENGINE



- Engine Feed Pipe Temperature Sensor - Installation
Figure 403

FUEL FEED PIPELINE AS DETAILED IN 28-21-00 OR 28-21-41.

(1) Remove the associated temperature sensor as detailed in paras.2.A., B. and C.

B. Remove

NOTE: When an engine feed pipe sensor pocket is removed, the securing bolts must be identified positively, for pocket installation, as one bolt is used for bonding purposes.

(1) Remove the bolts securing the pocket to the pipe adapter, remove the bonding lead (if applicable) and withdraw the pocket; discard the O-ring seal.

(2) Fit a suitable blank to the feed pipe aperture.

C. Prepare to Install

(1) Remove the blank from the feed pipe aperture.

(2) Inspect the sensor pocket, and feed pipe adapter flanges and bolt holes, for freedom from cracks, corrosion, distortion or other damage.

(3) Fit a new O-ring seal in the groove on the underside of the pocket securing flange.

D. Install

NOTE: Check the identity of the engine feed pipe sensor pocket securing bolts (Ref. NOTE to para.4.B.).

(1) Comply with the electrical safety precautions.

(2) Install the pocket in the feed pipe aperture.

(3) Fit the bonding lead (if applicable); ensure that the pocket is bonded in accordance with 20-27-11.

NOTE: Each washer must be installed with the chamfered face toward the bolt head.

(4) Secure the pocket with the bolts and washers; torque-tighten the feed pipe sensor pocket securing bolts to between 30 and 40 lbf in (0.339 and 0.452 mdaN) as detailed in 20-21-11; torque-tighten the collector tank sensor pocket securing

bolts to between 40 and 45 lbf in (0.452 and 0.509 mdaN) and lock them with 0.020 in (0.508 mm) dia. wire (DTD 189) in accordance with 20-21-11 and 20-21-13.

(5) Install the associated temperature sensor in the pocket as detailed in paras.2.D., E. and F.

(6) Pressure-test the engine fuel feed system and check that no leaks occur at the sensor pocket joint face (Ref. 28-21-00, Adjustment/Test).

E. Conclusion

(1) Remove the safety clip and reset the circuit breaker tripped before removal.

(2) Using the key, refit and lock the wing access panel.

TANK PRESSURE INDICATION - DESCRIPTION AND OPERATION

1. General (Ref. Fig. 001)

Venting and pressurization from an integral part of the fuel system. The fuel tanks are pressurized at a predetermined altitude (Ref. 28-12-00), this pressure and any variation, positive or negative, is sensed by a pressure transducer located in the right wing fairing, and connected into the main fuel gallery. Tank pressure indication is provided by an indicator
R and a warning caption, on panel 4-214 at the third crew member's (3CM) station.

R

R
R
R

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2. Pressure Transducer (Ref. Fig. 001)

The pressure transducer accepts pressure from two sources, ambient pressure, which is derived from tapping points on the side of the rear fuselage and taken via the No.11 fuel tank, and fuel tank pressure taken from the fuel gallery in the No.10 tank RH cell.

The transducer casing houses two sealed capsules of different sizes. The interior of the casing is subjected to ambient pressure through one of the two ports, this pressure acts on the outside of both capsules. Fuel tank pressure is led into the interior of the smaller capsule through a second port. This arrangement provides two different pressures, pa, the product of the larger, ambient sense capsule, and pt-pa, the product of the smaller, tank pressure capsule.

The resultant movements of the capsules provide two electrical signals by electro-mechanical means. These signals, representing pt-pa and pa, are transmitted to a differential pressure indicator, where they are adapted to provide the necessary tank positive or negative pressure information, and used to activate an external visual and audible warning if pressure exceed permitted limits.

3. Indicator

The differential pressure indicator is a servo-operated instrument that receives signals from the pressure transducer, and adapts them to provide visual indication of the differential between the internal fuel tank pressure and ambient pressure (pt-pa). A second signal (pa) is received by the indicator and

used directly to activate an external alarm.

Three comparators are housed within the indicator to analyze the following:

pt-pa: less than - 1.75 psig

pt-pa: greater than 4.0 psig

pt: less than 1.8 psia

The integrally illuminated dial presentation consists of a pointer rotating about a dial graduated from -2 to 6 psi, with four coloured sectors, green, yellow, amber and red, and two secondary resettable pointers controlled by solenoids within the instrument, externally operated by a LIMIT RESET push-switch on panel 23-214. The secondary pointers provide indication of any excessive negative or positive tank pressure.

A solenoid-operated, spring-loaded, diagonally striped failure warning flag signals power failure or loss of signal transmission to the indicator.

The indicator is adjacent to, and connected electrically to, an amber TANK PRESS caption.

4. Operation

A. Functional Description

With electrical power supplies connected to the fuel tank pressurization indication system, the pressure present in the fuel tanks (pt), as well as the ambient pressure (pa), is sensed by the transducer and a signal (pt-pa) is transmitted to the synchronous received in the indicator. A second signal (pa) is also transmitted to the indicator. The input signals are processed and amplified to power the instrument servo system, to drive the pointer to a position on the dial to give an accurate indication of tank pressure.

If the fuel tank positive or negative pressure exceeds the predetermined levels, one of the two secondary pointers is carried around the dial scale by the main pointer and held in position by a solenoid, the amber TANK PRESS caption is illuminated by a signal-stroke gong. As the main pointer returns to the normal operating section of the indicator dial the warnings are cancelled, but the associated secondary pointer is held in the excess pressure position (positive or negative) until reset by the operation of the reset push-switch, which de-energizes the hold-on solenoids.

If, at altitude, due to the reduced ambient pressure,

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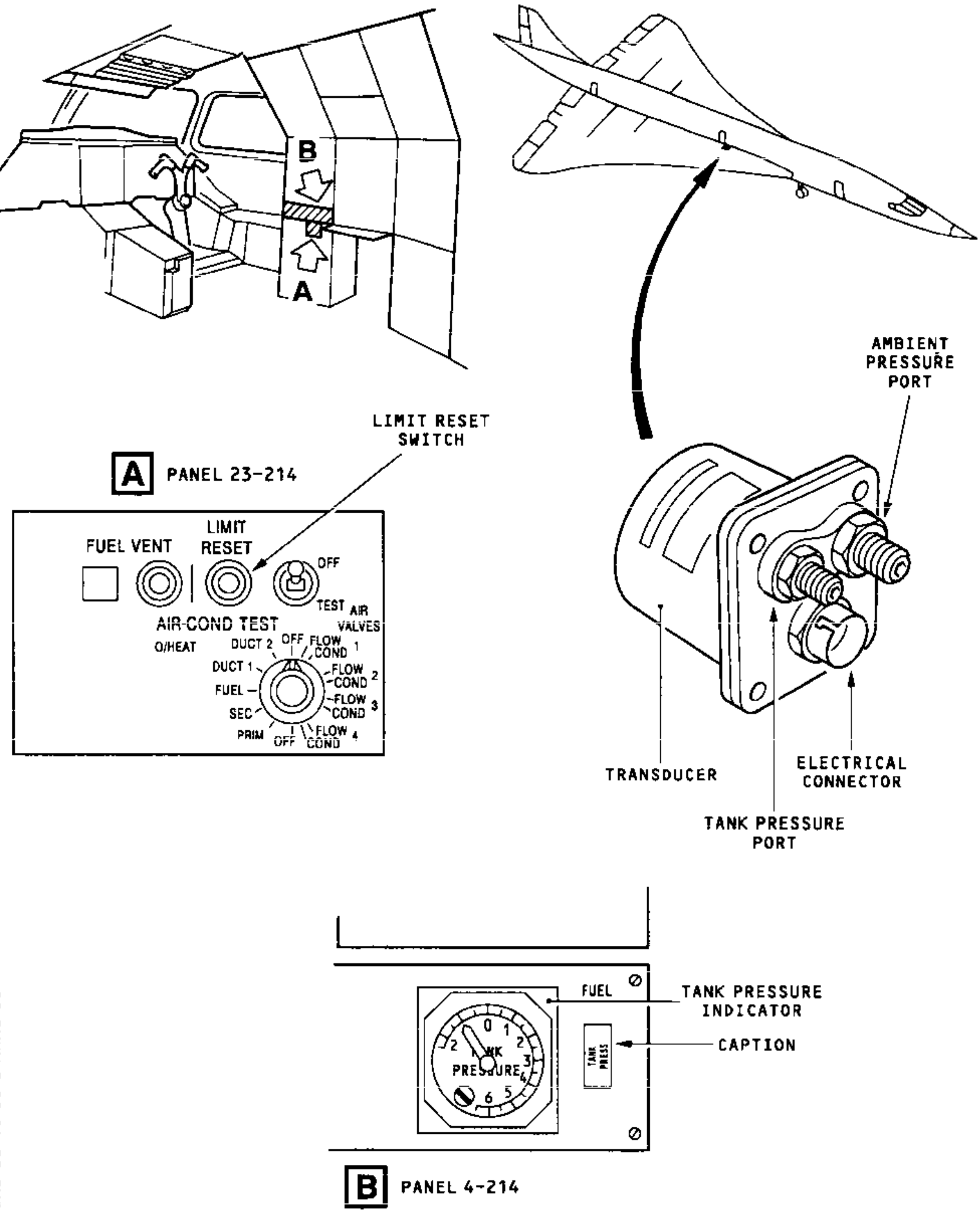

CMB 28 46 00 0 AAM0 00

R

Tank Pressure Indication System
Figure 001

R the pressure in the fuel tanks falls to approximately 1.8 psia (pt-pa+pa) the TANK PRESS caption is illuminated, irrespective of the differential pressure reading on the indicator, accompanied by an amber FUEL master warning and single-stroke gong.

If power supplies to the indicator fail during operation, or there is a loss of signal from the transducer, the failure flag holding solenoid is de-energized and the spring-loaded flag is displayed in the counter aperture.

B. Electrical Power Supplies

Electrical power supplies for the indicator are taken from the 'B' essential 28 V d.c. busbar and the 'B' essential 26 V a.c. busbar; supplies for the transducer are taken from the 'B' essential 26 V d.c. busbar.

TANK PRESSURE INDICATION - TROUBLE SHOOTING

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

Faults are dealt with on a probability basis and identified as a result of testing.

The defect can be isolated with the aid of trouble shooting procedures (Ref. para.3.), and traced through IF OK and IF NOT OK paths to the appropriate charts or other specified rectification action as may be necessary. If a defect occurs, perform the appropriate rectification action, then repeat the operation at which the defect was encountered to ensure that the operation is OK.

Bracketed numbers in the procedures and charts indicate items on the component identification table (Ref. Table 101). The table provides information, including component location, required for rectification. Component location also indicates the possible necessity of repositioning certain items of ground service equipment. Each chart also specifies the ground equipment required for that particular task.

All procedures dealing with trouble shooting are based on the assumption that electrical wiring is serviceable, all associated circuit breakers are set and electrical power is available, unless otherwise stated. If the fault is not rectified, check the wiring in accordance with the Wiring Diagram Manual (Ref. Table 101).

2. Preparation

A. Ensure that the associated circuit breakers are set (Ref. Table 101).

B. Make available electrical ground power as detailed in 24-41-00.

C. Gain access to the pressure transmitter (Ref. 28-46-21, Removal/Installation), and check that the connections and pipe runs are secure and free from leaks.

D. Test the amber TANK PRESS caption filaments as detailed in 33-14-00.

3. Trouble Shooting

A. Prepare to trouble shoot (Ref. para.2.) Check that the indicator dial pointer reads approx. zero (static), depending on ambient pressure, that the failure flag is withdrawn completely, and the secondary pointers have reset. Operate LIMIT RESET push-switch to reset secondary pointers, as necessary. IF -

- NOT OK —
  1. Indicator dial pointer reads incorrectly or sluggishly, but failure flag is withdrawn - Chart 101.
  2. Failure flag is not withdrawn when power is connected - Chart 102.
  3. Secondary pointers do not reset when LIMIT RESET push-switch is operated - Chart 103.
- OK — proceed to B.

B. Check that the TANK PRESS caption is illuminated when the fuel tank pressure limitations are exceeded (Ref. Adjustment/Test). IF -

- NOT OK — TANK PRESS caption not illuminated when fuel tank limitations exceeded - Chart 104.
- OK — proceed to C.

C. Switch off and disconnect electrical ground power as detailed in 24-41-00; check that the indicator dial pointer reads zero (approx.) and the failure flag appears in the aperture window. IF -

- NOT OK — Renew Indicator (3).

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INDICATOR DIAL POINTER READS INCORRECTLY OR SLUGGISHLY, BUT FAILURE FLAG IS WITHDRAWN.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

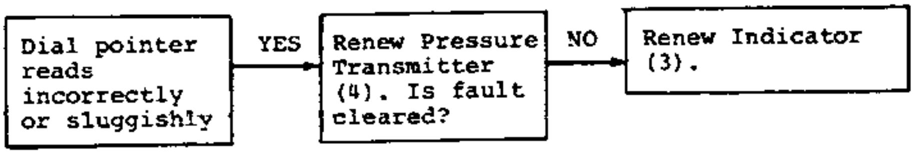

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Chart 101

FAILURE FLAG IS NOT WITHDRAWN WHEN POWER IS CONNECTED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

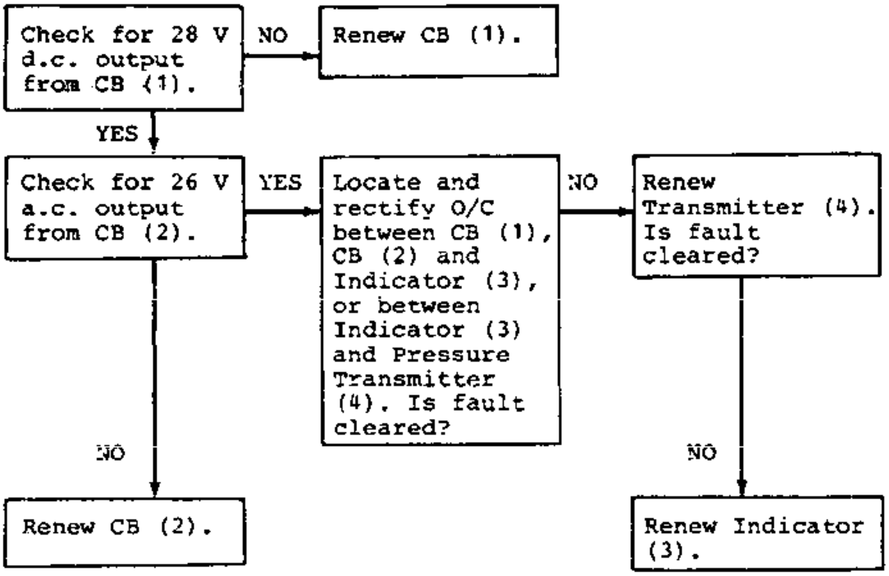

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Chart 102

SECONDARY POINTERS DO NOT RESET WHEN LIMIT RESET PUSH-SWITCH IS OPERATED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

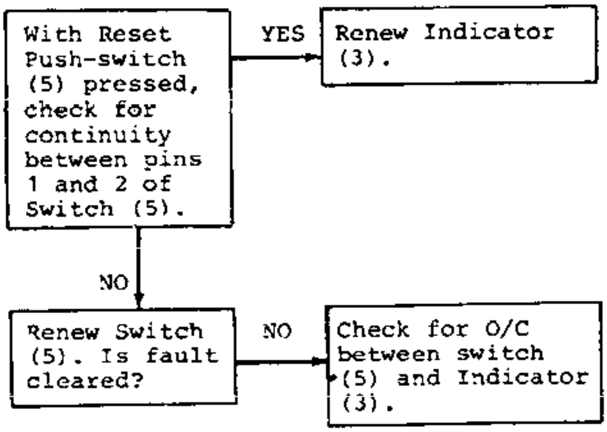

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Chart 103

'TANK PRESS' CAPTION NOT ILLUMINATED WHEN FUEL TANK LIMITATIONS EXCEEDED.

GROUND EQUIPMENT REQUIRED	
DESCRIPTION	PART NO.
GROUND POWER SUPPLY	-
MULTIMETER	-

Locate and rectify O/C between caption and Indicator (3).

NO → Renew Indicator (3).

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Chart 104

ITEM NO. AND DESCRIPTION	ACCESS PANEL	PANEL/ ZONE	EQUIP. IDENT.	POSITION	MANUAL REF. MAINT. TOPIC	WIRING DIAGRAM
(1) Circuit breaker 28 V	-	3-213	D210	Map ref.F6	24-50-00 R/I	28-46-01
(2) Circuit breaker 26 V	-	4-213	D211	Map ref.F3	24-50-00 R/I	28-46-01
R (3) Tank pressure indicator	-	4-214	D213	3CM station	28-46-31 R/I	28-46-01
R						
R						
R						
R						
(4) Tank pressure transmitter	292 FT	-	D214	Right upper wing fillet	28-46-21 R/I	28-46-01
(5) Reset push-switch	-	23-214	E391	3CM station	77-11-00 R/I	77-11-08

Component Identification
Table 101

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TANK PRESSURE INDICATION - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General (Ref. Fig. 401)

This topic contains instructions for the removal and installation of a caption light module with the legend TANK PRESS, associated with the tank pressure indication system.

R The caption light module is located in the rear section of the flight compartment on the fuel tank pressure panel (4-214) at the third crew member's (3CM) station.

R

R
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R

The module is secured to the panel by a module clamp, and electrical connections are made to socket-type terminals at the rear of the module body.

2. Caption Light Module (Ref. Fig. 401)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clips	-

B. Prepare

(1) Trip the TANK PRESSURE RESET & WL SUP circuit breaker D210 on panel 3-213, map ref.F6, and TANK PRESS IND SUP circuit breaker D211 on panel 4-213, map ref.E3, and fit safety clips.

C. Remove

R (1) Release the fasteners securing the fuel tank pressure panel, 4-214, to the 3CM station structure and withdraw the panel sufficiently to gain access to the electrical connectors at the rear of the caption light module

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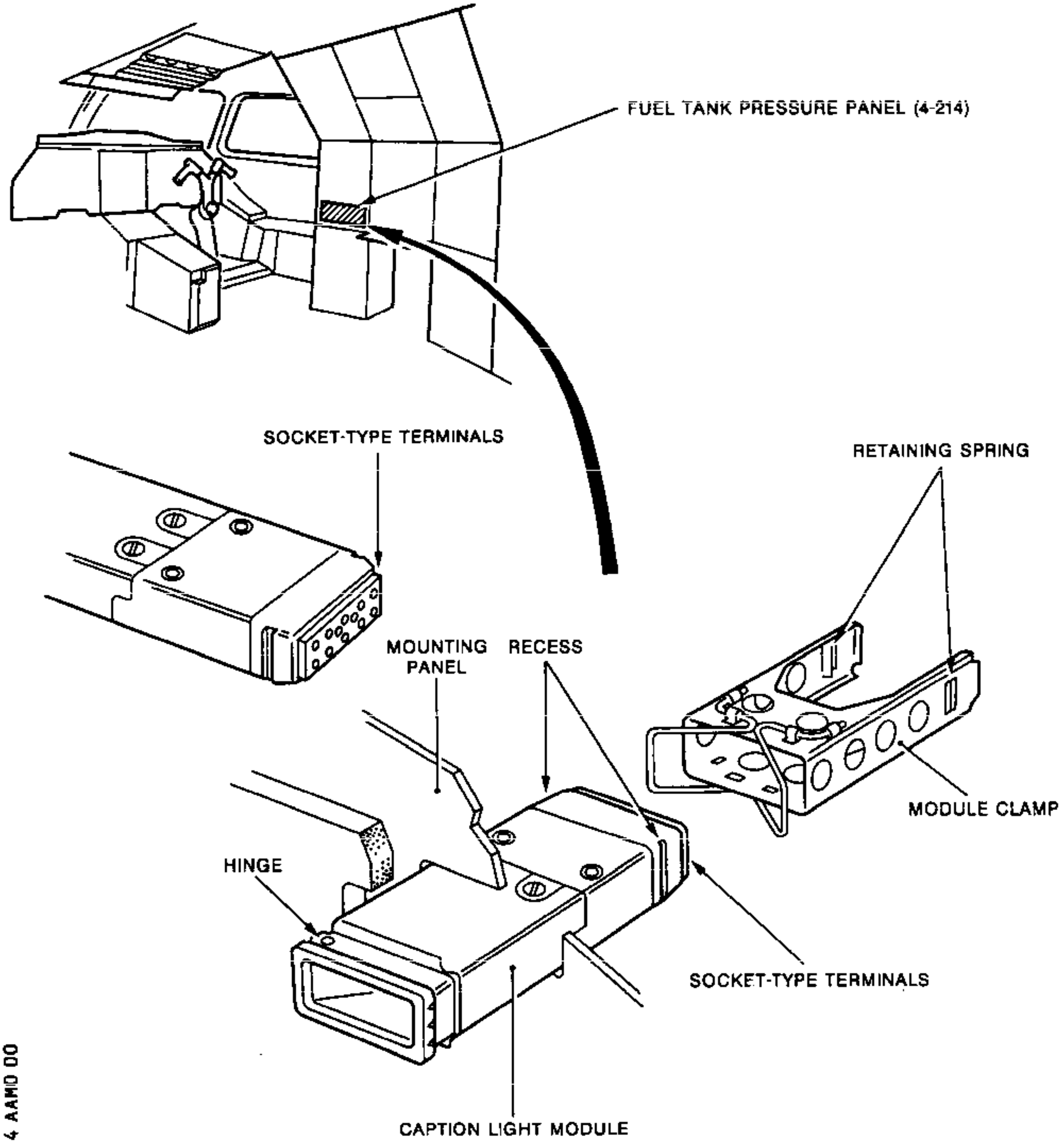

CAPTION LIGHT MODULE - 'TANK PRESS'

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R

Caption Light Module - Installation
Figure 401

R

R
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R
R

(2) Withdraw the pin inserts from the socket-type terminals in accordance with the Wiring Diagram Manual, 20-42-18.

(3) Disengage the clamp retaining springs at the rear of the module, and withdraw the module from the front of the panel the clamp from the rear.

D. Install

(1) Comply with the electrical safety precautions.

(2) Position the clamp at the rear of the panel and insert the caption light module through the panel aperture from the front, ensuring that the hinged edge of the module is in alignment with the white-painted line on the back of the panel.

(3) Hold the module firmly against the front of the panel and press the clamp into position from the rear until the retaining springs engage the recesses in the module body.

(4) Connect the electrical cables to the module in accordance with the Wiring Diagram Manual, 20-42-18, ensuring that the connections are made in accordance with the cable identifications and the applicable wiring diagram.

(5) Refit the panel to its mounting on the 3CM station structure and secure it with the fasteners.

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Check the operation of the caption light module by carrying out the appropriate test procedures.

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TANK PRESSURE INDICATION - ADJUSTMENT/TEST

WARNING OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General

This Functional Test proves the operation of the components in the fuel tank pressure indication system, including the activation of the master warning system, when pressure limitations are exceeded. Operational and System Tests are not considered necessary in this application.

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2. Functional Test

A. Equipment and Materials

DESCRIPTION	PART NO.
Regulated, clean, dry air supply, 0 to 5 psig	-
Vacuum test set, 0 to -2 psig	-

B. Prepare

(1) Gain access to the tank pressure transmitter (Ref. 28-46-21, Removal/Installation).

(2) Disconnect the tank (P) connection from the transmitter and connect a source of clean dry regulated air, complete with a test pressure gauge.

(3) Make available electrical ground power as detailed in 24-41-00.

C. Test

R (1) Refer to panel 4-214 at the third crew member's (3CM) station. Check that the tank pressure gauge reads zero, and the failure warning flag is withdrawn.

R

R
R
R

(2) Press the TANK PRESS amber caption and check that -

(a) the caption is illuminated,

(b) the AMBER fuel caption is illuminated on the master warning panel, and

(c) the audio warning (single-stroke gong) sounds.

(3) Release the TANK PRESS caption and ensure that the warnings are cancelled.

(4) Note the readings on the flight compartment indicator and the test gauge; gradually increase the air pressure supply to the transmitter to 5.0 psig.

(5) When the indicator reading is 4.0(±0.01) psig, check that the TANK PRESS caption is illuminated, and the master warning is activated (Ref. para.(2)).

(6) Gradually release the pressure at the transmitter; check that the warning is cancelled, the main pointer has returned to zero, and the right secondary pointer is locked on at the 5 psig position.

(7) Disconnect the air supply from the transmitter and connect in a vacuum test set.

(8) Note the readings on the flight compartment indicator and the test set, and reduce the pressure gradually to -2 psig.

(9) When the indicator reading is -1.75(±0.01) psig, check that the TANK PRESS caption is illuminated, and the master warning is activated.

(10) Release the depression gradually; check that the warning is cancelled, the main pointer has returned to zero, and the left secondary pointer is locked on at the -2 psig position.

(11) Refer to panel 23-214 at the 3CM station; press the LIMIT RESET push-switch and check that the tank pressure indicator secondary pointers return to the zero position, then release the push-switch.

D. Conclusion

(1) Switch off and disconnect electrical ground power as detailed in 24-41-00.

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(2) Check that the failure warning flag has appeared in the aperture in the indicator dial face.

(3) Disconnect the test set from the transmitter, and reconnect the tank pressure pipeline to the S connection (Ref. 28-46-21, Removal/Installation).

(4) Replace the access panel removed in operation B.(1).

TANK PRESSURE TRANSDUCER - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

OBSERVE THE FUEL SAFETY PRECAUTIONS DETAILED IN 28-00-00 AND 28-10-00.

1. General

The fuel system pressure transducer is bracket-mounted in the forward area of the right upper wing fillet.

2. Tank Pressure Transducer (Ref. Fig.401 and 402)

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-
Torque spanner, 40 to 60 lbf in (0.452 to 0.678 mdaN)	-
Torque spanner, 75 to 125 lbf in (0.848 to 1.413 mdaN)	-
Torque spanner, 145 to 155 lbf in (1.638 to 1.751 mdaN)	-
Regulated, clean, dry air supply, 0 to 11 psi (0 to 0.7 bar)	-
Locking wire, 0.036 in dia., (0.91 mm)	-

B. Prepare to Remove

(1) Electrically isolate the transducer by tripping the TANK PRESS IND SUP circuit breaker D211 on panel
R 4-213, map ref.E3; fit a safety clip.

(2) Gain access to the transducer by removing access panel 292 FT from the right upper wing fillet.

C. Remove

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R (1) Disconnect the electrical connector from the front face of the transducer.

R (2) Unscrew the pipe coupling nuts from the adapters on the transducer.

R (3) Identify the special bolt before removal, then remove the securing bolts and washers; withdraw the transducer from the mounting bracket.

NOTE: The bolt at the corner to the left of the electrical connector is a special bonding bolt, and must not be confused with the other securing bolts.

R (4) Unscrew and remove the adapters from the transducer for re-use on the replacement item and fit suitable blanks; discard the O-ring seals.

R (5) Fit suitable blanks to the open pipe ends.

R D. Prepare to Install (Ref. Fig. 402)

R NOTE: The "FLAME TRAP" adapter is installed in the tank pressure (P) port in the transducer.

R (1) Check that the ring of holes in the flame trap adapter is clean and free from obstruction.

R (2) Remove the blanks from the threaded ports in the transducer.

R (3) Fit new O-ring seals to the adapters, then screw the smaller, FLAME TRAP adapter into port P, and the larger adapter into port S.

R (4) Torque-tighten the flame trap adapter to between 107 and 117 lbf in (1.209 and 1.322 mdaN) and the larger adapter to between 145 and 155 lbf in (1.638 and 1.751 mdaN).

R (5) Connect the source of clean, dry, regulated air, complete with a test pressure gauge, to both ports.

R (6) Apply a pressure of 10.2 psig (0.7 bar) simultaneously to both ports; shut off the air supply and check that this pressure is maintained, with no reduction, for 15 min.

R NOTE: No leaks are permissible during this test.

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R (7) Release the pressure gradually, then disconnect
R and remove the test equipment.

R (8) Wire-lock the adapters together as detailed in
R 20-21-13.

R (9) Using a 500 V d.c. insulation resistance tester, check that the insulation resistance between the metal case of the unit and all pins connected together, with the exception of pin D, is greater than 20 Mohm.

R (10) Check that pin D has electrical continuity (0.020 ohm max.) with the case.

E. Install

R NOTE: Pipe coupling to transducer connections must be made in accordance with 20-23-11.

(1) Comply with the electrical and fuel safety precautions.

R (2) Remove the blanks from the transducer adapters
R (if fitted) and the pipe ends.

R (3) Position the transducer on the bracket and secure it with the bolts and washers in the locations previously identified on removal (Ref. para.2.C.(3)).

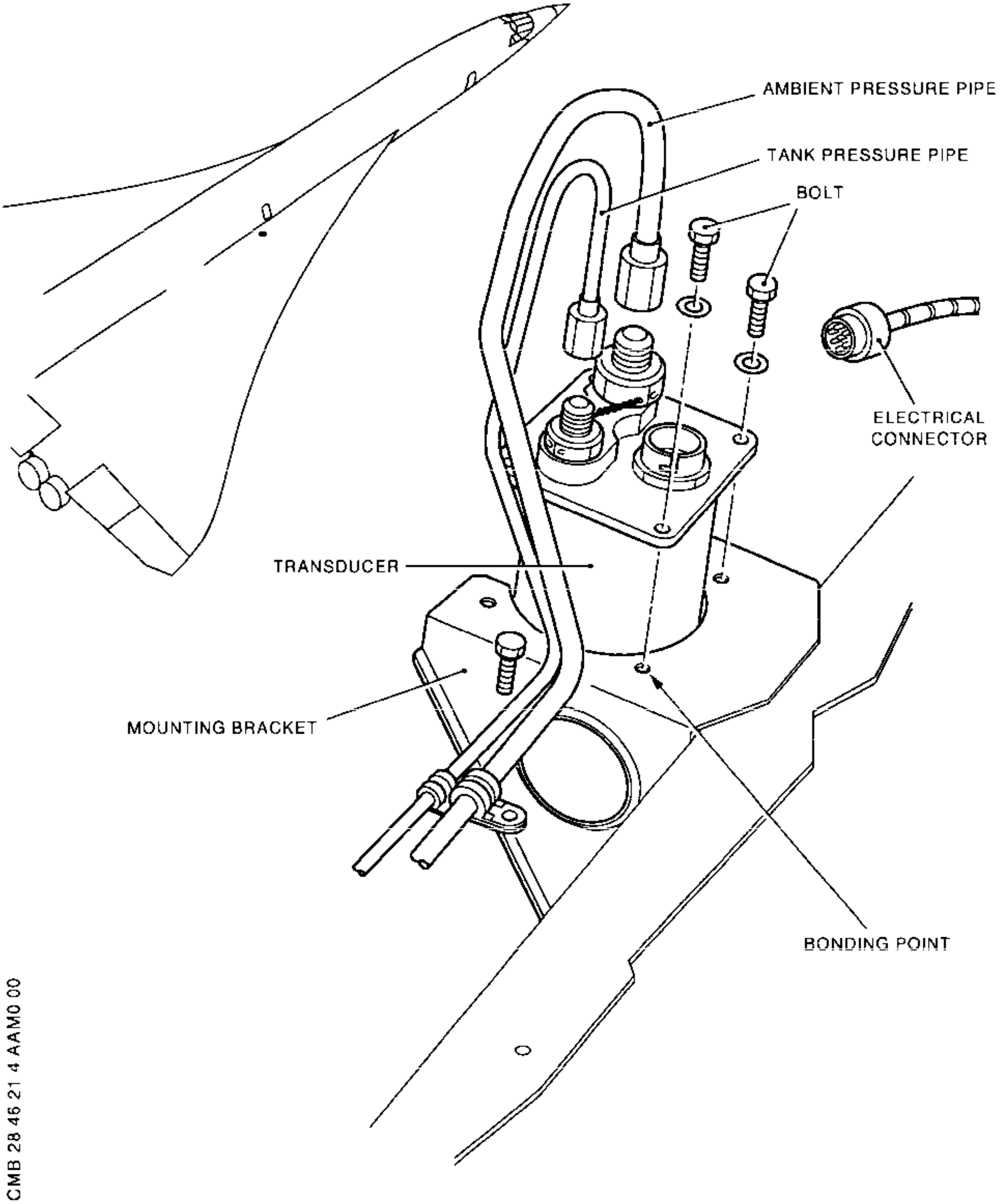
NOTE: Ensure that the unit is bonded electrically by the special bolt, in accordance with 20-27-11.

(4) Connect and tighten the coupling nuts to the
R adapters on the transducer. Torque-tighten the
R tank pressure line 'P' (smaller) nut to between 40
R and 60 lbf in (0.452 and 0.678 mdaN), and the
R ambient sense line 'S' (larger) nut to between 75 and
R 125 lbf in (0.848 and 1.413 mdaN).

(5) Connect the electrical connector to the
R transducer, ensuring that the mating surfaces
are clean and undamaged.

F. Conclusion

(1) Reset the circuit breaker tripped before removal.



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R

Pressure Transducer - Installation
Figure 401

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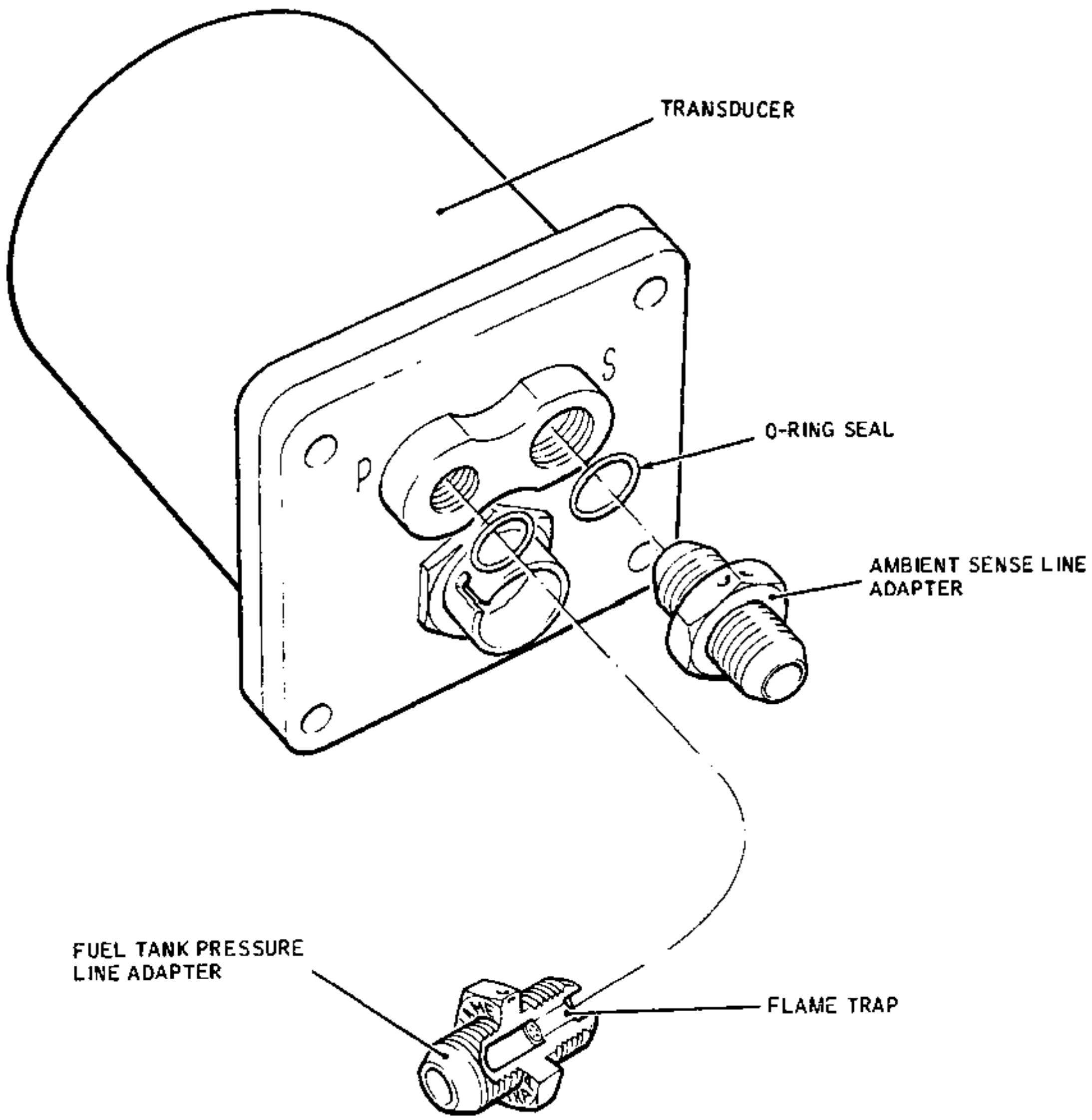

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R - Transducer Adapters - Installation
Figure 402

(2) Replace the wing fillet access panel 292 FT.

(3) Perform a Functional Test of the fuel tank pressure indication system as detailed in 28-46-00, Adjustment/Test.

TANK PRESSURE INDICATOR - REMOVAL/INSTALLATION

WARNING: OBSERVE THE ELECTRICAL SAFETY PRECAUTIONS DETAILED IN 24-00-00.

1. General

R The fuel tank pressure indicator is mounted on panel 4-214 at the third crew member's (3CM) station.

R

R
R

2. Tank Pressure Indicator

A. Equipment and Materials

DESCRIPTION	PART NO.
Circuit breaker safety clip	-

B. Prepare

(1) Electrically isolate the indicator by tripping the circuit breakers. Fit safety clips.

SERVICE	PANEL	CIRCUIT BREAKER	MAP REF.
TANK PRESS RESET & WL SUP	3-213	D20	F6
TANK PRESS IND SUP	4-213	D211	E3
3CM STN INST LTS SUP	13-216	L377	E7
3CM STN RH LT TEST SUP	15-215	L1006	D14

C. Remove

(1) Unscrew the clamp adjusting screws sufficiently to permit the indicator to be withdrawn.

(2) Withdraw the indicator from the panel and disconnect.

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the electrical connector.

D. Install

(1) Comply with the electrical safety precautions.

R (2) Connect the electrical connector (colour coded green) to the indicator, ensuring that the mating surfaces are clean and undamaged.

(3) Install the indicator in the panel aperture.

(4) Align the face of the indicator correctly, and torque-tighten the clamp adjustment screws to between 5 and 8 lbf in (0.0565 and 0.0904 mdaN).

E. Conclusion

(1) Remove the safety clips and reset the circuit breakers tripped before removal.

(2) Make available electrical ground power as detailed in 24-41-00.

(3) Check that the indicator reads zero.

(4) Press and release the TANK PRESS caption, and check that the caption is illuminated, then extinguished.

(5) Check that the failure warning flag is withdrawn completely, and that the indicator dial is illuminated evenly.

(6) Switch off and disconnect electrical ground power as detailed in 24-41-00.

(7) Check that the failure warning flag has appeared in the aperture window.

END OF THIS SECTION

NEXT